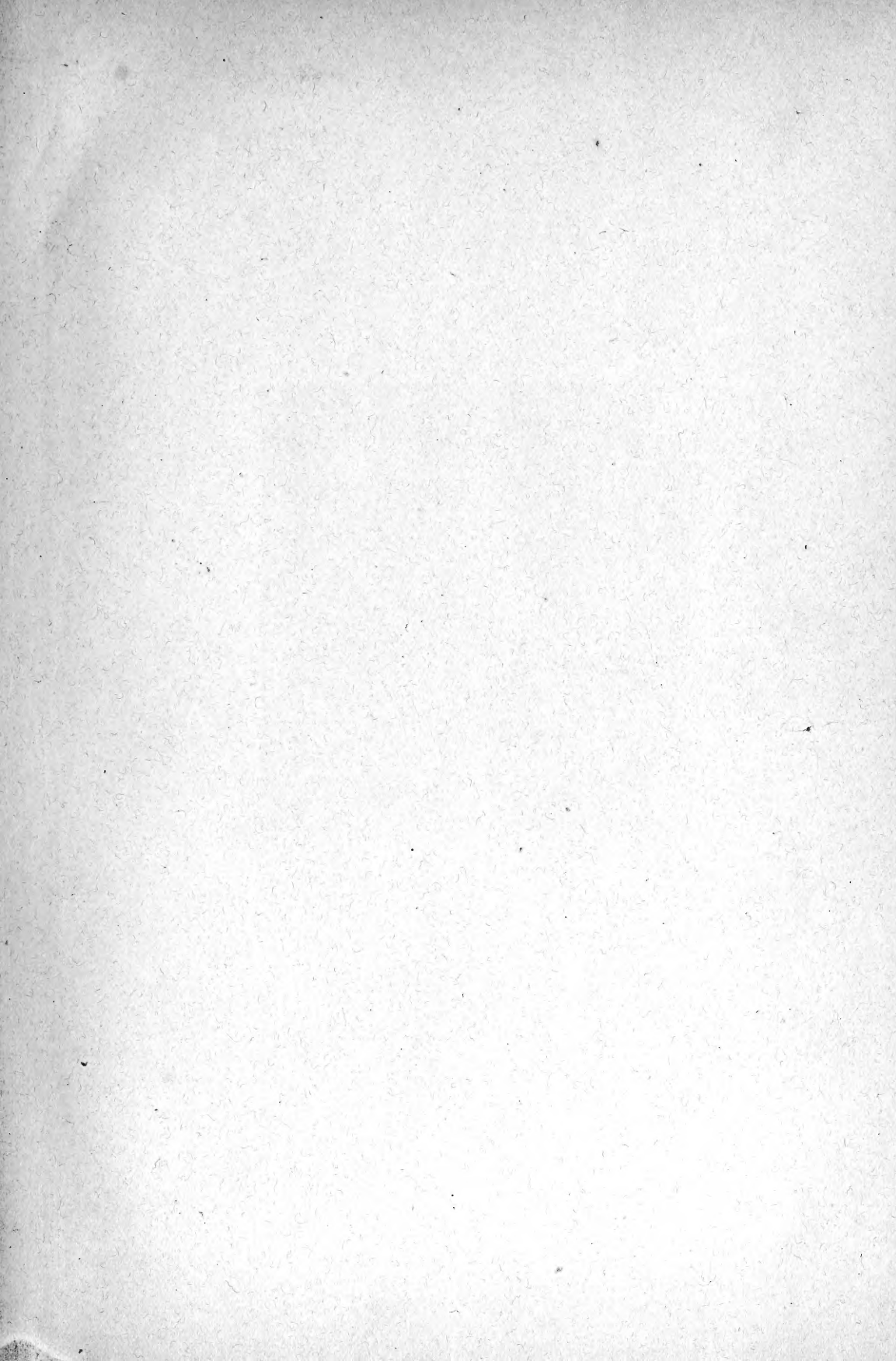
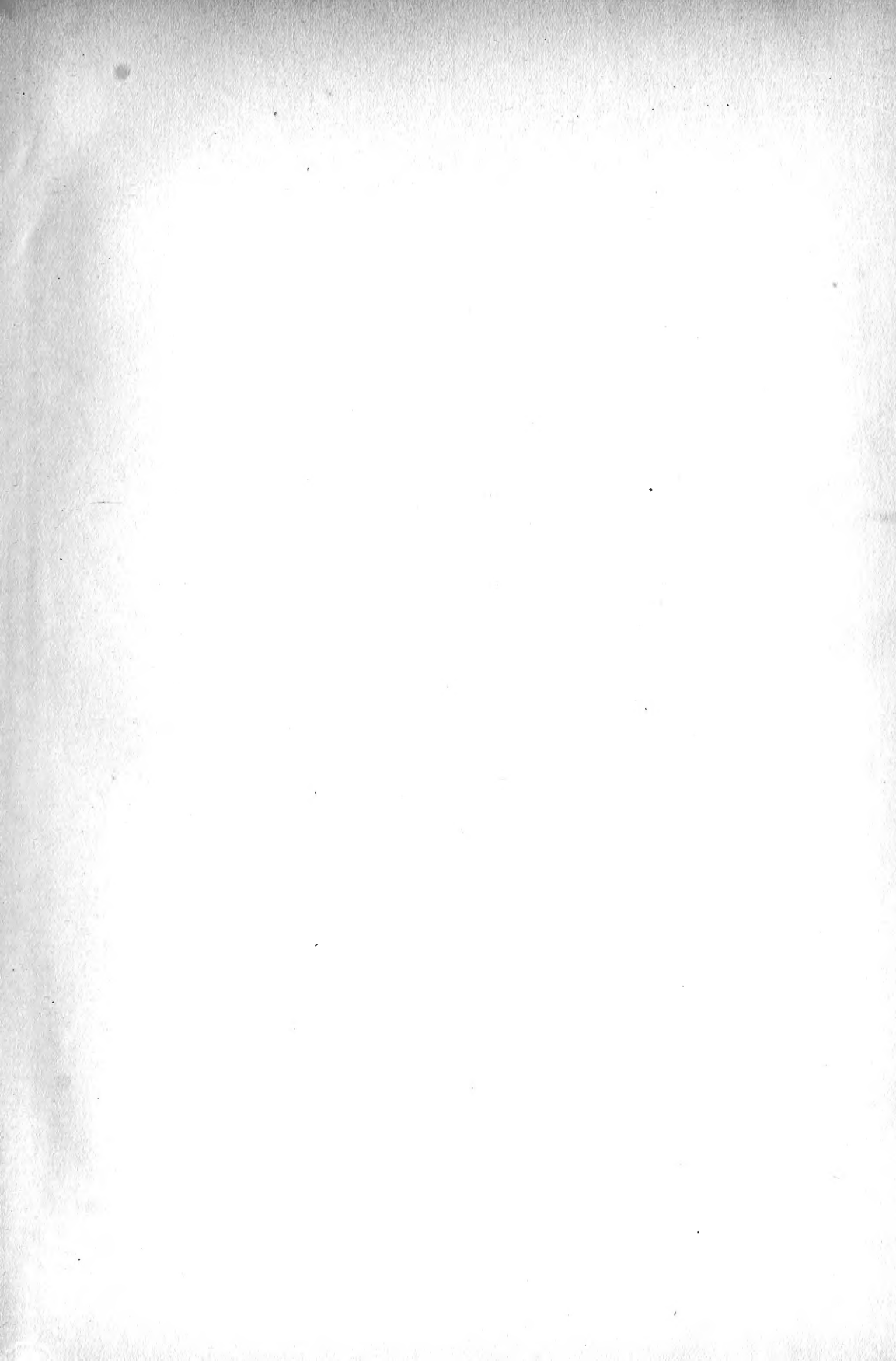


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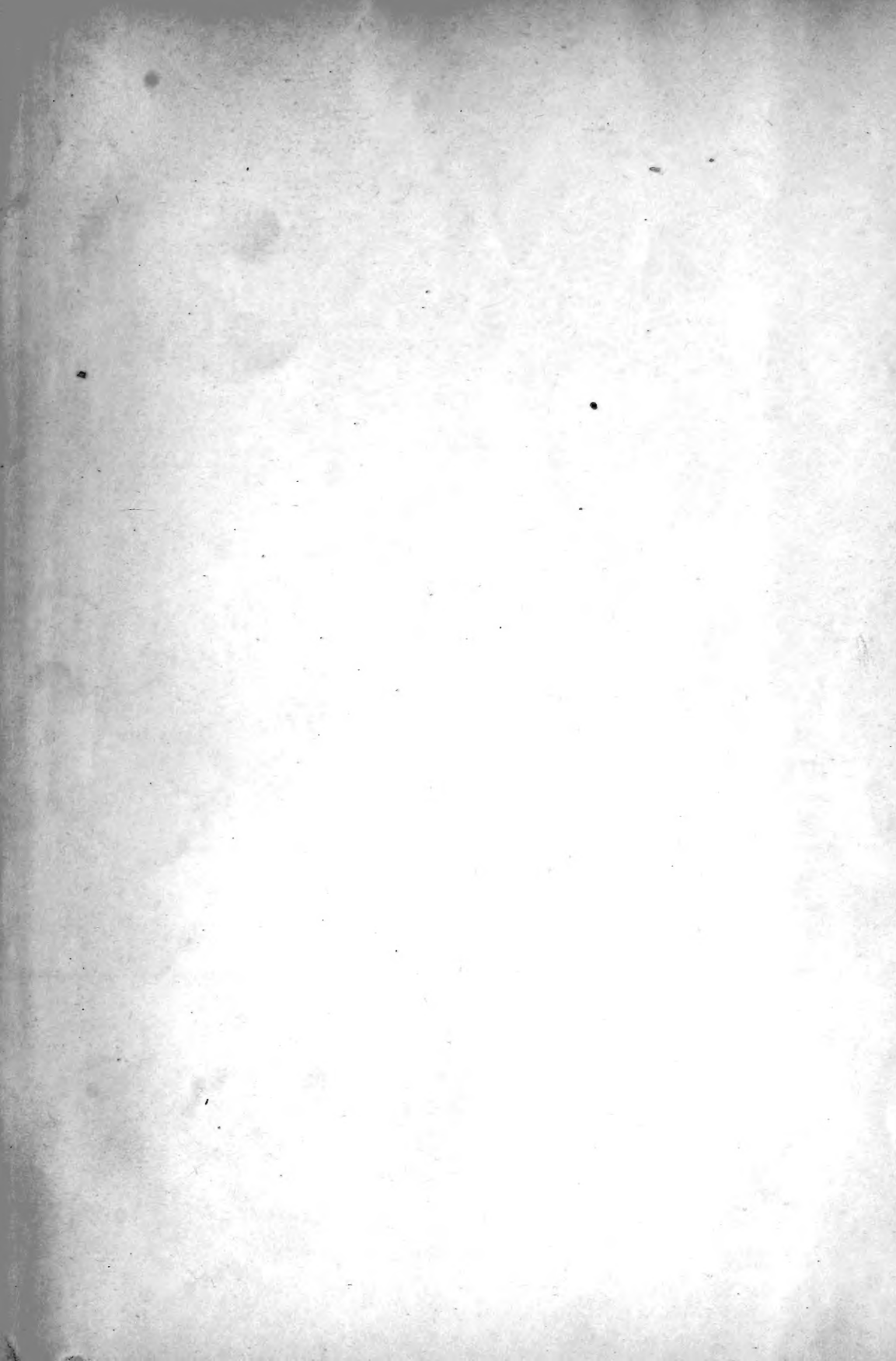
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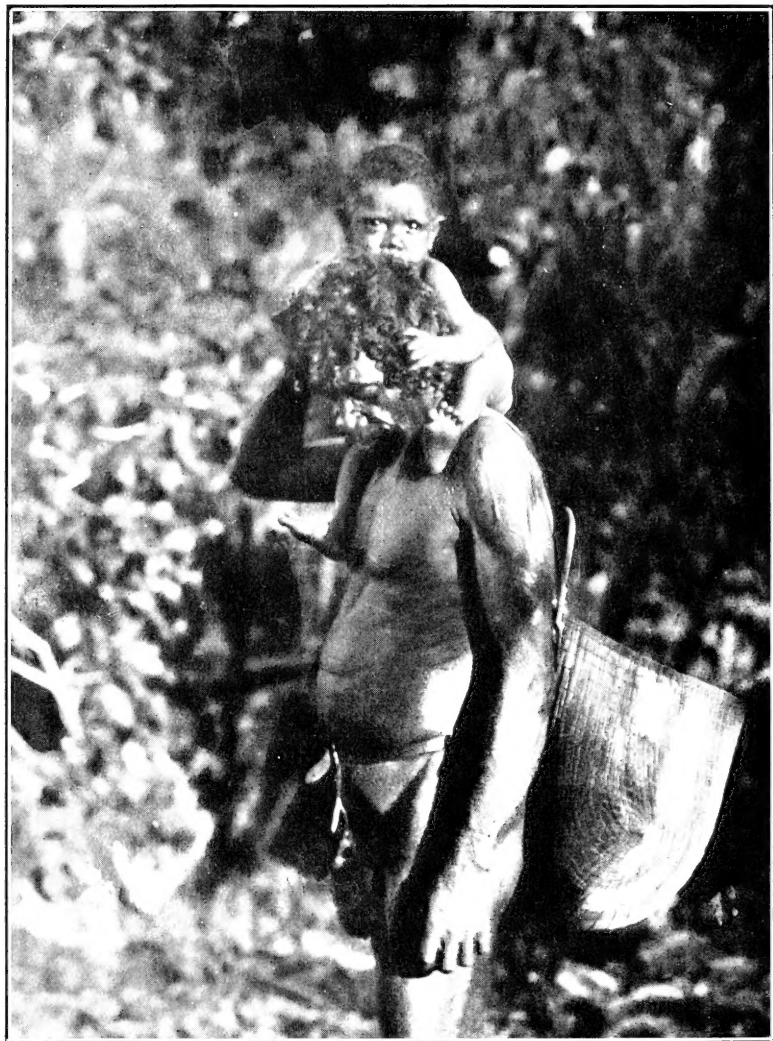












A NATIVE OF CAIRNS DISTRICT, N.Q.

The child sits astride the old man's neck and holds on to his hair in grim earnest. A usual method employed throughout Queensland.

A. Atkinson, photo. (1900).

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MEMOIRS

500(14.3)

OF THE

QUEENSLAND MUSEUM

VOL. V.

WITH PLATES AND FIGURES IN THE TEXT.

EDITED BY THE DIRECTOR

R. HAMLYN-HARRIS, J.P., D.Sc., F.L.S., F.R.M.S., F.Z.S., &c.

ISSUED JULY 10, 1916.

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DILLYBAG MAKING.

Three women in camp (Cairns, N.Q.), one of which is in the process of making a dillybag. In the background a native hut or mia-mia has been built of banana leaves (*Musa* sp.).

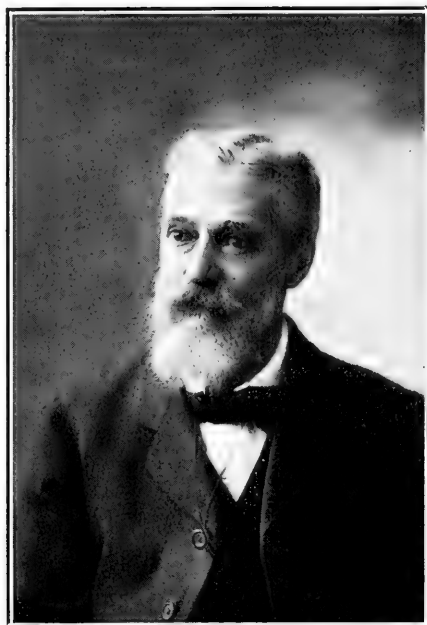
A. Atkinson, photo. (1898).

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[illegible]



THE LATE MR. CHARLES W. DE VIS, M.A.

Obit April 30th, 1915; aged 87.

For nearly thirty years the late Mr. Charles W. de Vis was closely associated with the Queensland Museum, and during the major portion of that time he acted as Curator. The deceased scientist accomplished a very considerable amount of work as a vertebrate biologist in the elucidation of the Queensland and New Guinea faunæ, and his efforts as a systematist are represented in mammalian, avian, reptilian, and piscine orders. He also contributed several important papers as the result of his researches on the fossil marsupialia, birds, and reptilia. His cosmopolitanism is evidenced by the voluminous nature of the manuscripts he left behind, and the wide range of his studies is interesting as representing what may well be called a pioneer phase of Australian science. Unassuming in temperament, he united devotion to science with a quiet culture, and these characteristics gained for him the esteem of many friends.

ON FISH POISONING AND POISONS EMPLOYED AMONG THE ABORIGINES OF QUEENSLAND.

By R. HAMLYN-HARRIS, D.Sc., F.L.S., ETC., AND FRANK SMITH, B.Sc., F.I.C.

(Plates IV. and V. and One Text-figure.)

THE practice of employing vegetable poisons for stupefying or killing fish is by no means confined to the aboriginal inhabitants of North-Eastern Australia, but is in vogue almost universally and dates back to ancient times; the method did not even escape the notice of the wily English poacher.

We find similar methods to those adopted here practised in other parts of Australia, viz., New South Wales, Victoria, Northern Territory, and Western Australia. Central and South Australia are excepted, local conditions being generally unfavourable to their application; whilst the Tasmanians never used fish-poisons at all; they never attempted to catch fish at any time, strange as it may appear, and confined their attention to the taking of shellfish, crays, and mussels. (*Beattie.*)

As far as South and Central Australia are concerned, Professor E. C. Stirling says: "I have no knowledge that fish-poisons are used in these regions. I never heard of the practice during my two visits to the MacDonnell Ranges, where from the localised and restricted conditions of the waters it might be practicable; and I have recently had my own opinion confirmed by the more extended knowledge of an observant friend who spent many years in the MacDonnells. The natives there do, however, poison with pituri the waters where emus drink. In the southern parts of South Australia, where the fish are got from the large lakes and River Murray, the practice would be impossible."

With reference to Western Australia we know very little; such mention of fish-poisons as E. Clement favours us with when he says "fish is caught either with nets or are stupefied by a plant called 'Kurrurru' which is placed into the pools"¹ is of little more scientific value than a record, since probably by this time the identity of the plant is unfortunately lost.

Going further afield, we find that their use was known in Malaysia to a considerable degree, to parts of Polynesia and Melanesia, India, South Africa, South America, and amongst the North American Indians.

Expert navigators and canoe-builders such as the Maoris never used them. Fish are very plentiful all around the coast, and they probably never

¹ "Ethnological Notes on the Western Australian Aborigines," publications of the Royal Ethnographical Museum at Leyden, series 2, No. 6, reprinted from *International Archiv. für Ethnographie*, vol. 16, 1903.

experienced any difficulty in obtaining all they required. Mr. Cheeseman, the Curator of the Auckland Museum, has pointed out that it is rather curious, considering the extent to which fish-poisons are employed in Polynesia, but that on the other hand none of the plants used in Polynesia extend to New Zealand, and that they have very few poisonous species of their own. This just suggests the idea that the plentiful growth of poisonous shrubs may be one of the reasons why the Malaysians employed fish-poisons universally, in spite of the fact that they too might be regarded as expert navigators, and might have got all the fish they required by more legitimate means.

Pliny the Elder² not only states that fish-poisons were used with success on the Roman Campania, but that lime was used as an adjunct. That the fish were attracted by the plant Pliny emphasises, but what part the lime played in the killing process he does not say.

Lime is used with effect in the Western Pacific, and the late Douglas Rannie spoke from personal experience when he said: "Lime produced from calcined or burnt coral is utilised for many purposes and in a great variety of ways by the natives inhabiting the many islands of the Western Pacific with whom I have come into contact. One practice I have seen reverted to, but one which does not gain favour with the permanent residents of a district, is that of employing lime to catch a big haul of fish. This plan is simply to throw a quantity of lime into a waterhole in some freshwater stream or creek, which has the almost instantaneous effect of killing all the fish in and below the waterhole for some considerable distance down the stream. But as this method kills far more fish than is usually required, it is looked upon as reprehensible and wasteful, and is as a rule only adopted by natives' travelling parties, and strangers poaching on others' properties far off from their own homes. I have seen marauding parties of head-hunters using this means of obtaining fish from freshwater streams on the west coast of Gaudalcanar, Solomon Islands. I have also seen war parties poaching in similar manner in the rivers of Malaita. As these people are betel-nut eaters they always carry a plentiful supply of lime. I have never seen them killing with lime in the salt water, so cannot say if it would be as effective in salt water as it is in fresh."

Relative to the genesis of fish-poisoning practice among the Queensland aborigines, regard is had to the possible acquisition of poison lore due to external influence, the independent adoption of the practice from chance observation, and to the evidence for experimentation leading to the distinction of toxic from non-toxic plant varieties.

The universality of the practice in Malaysia and the Islands has been referred to. *Derris* and *Tephrosia* species, widely used for the purpose, are common fish-poisons both in the Archipelago and Polynesia, and among tribes in Northern Queensland. The possibility of the introduction of the custom from such quarter must be judged on general grounds and by the standard of recognised external influence upon aboriginal customs.

Considering the universality of fish-poisoning it is not unjustifiable to assume an independent origin among the Australian aborigines, and the evolution of an empirical knowledge of efficient piscicides. The aboriginal himself would appear to have retained no notion of the origin of the art. His impression conveyed in his own way, "Black fella come up first time, catch 'em!" denotes the bequest of an unwritten lore through generations. Further his child-mind seeks for no explanation, nor is it legitimate to press for reason an intelligence

² 25th Book Natural History, chapter 54.



NATIVES ON A HUNTING AND FISHING EXPEDITION, CARRINGTON,
NEAR ATHERTON, N.Q.

The illustration shows the methods of carrying small children, still in vogue, and the attachment of the dillybag by means of its lawyer-cane handle to the forehead of the older man so as to leave the hands free for other tasks.

The waterhole is adapted to fishing by poisoning, the fish when secured being carried home in these dillybags.

that is at best but that of an overgrown youth. The explanation of E. J. Banfield that the need of the moment supplied the need of the moment, that the native fisher resorted to plant material abundant and ready to hand, though probably accounting for the first employment of fish-poisons, subsequently from their recognised efficiency adopted and widely used, does not suffice for the general and deliberate usage of plants of marked and certain toxic qualities—usage dictated, it seems, by distinct foreknowledge and intent. The recent use as a poison of the exotic *Asclepias curassavica* by natives on the Don River, and which may be supposed to be frequently efficacious from its botanical association with other Asclepiadæ, is an instance of the extension of aboriginal poison lore, probably as a result of experience, though the usage of the innocuous *Sarcocephalus cordatus* and *Pleiogynium solandri*, recorded as fish-poisons from the Proserpine district, warrants the opinion quoted—that plant material was used without direct recognition of its effectivity or non-effectivity, probably sometimes because it was readily obtained. The use of *Alocasia macrorrhiza*, which at least is likely to prove not certainly efficacious (from the abundant occurrence of the plant in moist and low-lying situations often adjacent to watercourses), may be cited as an example of the tendency to resort to material conveniently and expeditiously obtained. It may be surmised that the employment of *Polygonum* species was first dictated by similar circumstances.

The use or successful use of certain poisons was indubitably prescribed in measure by natural circumstances. If, for instance, the toxic principle of *Diospyros hebecarpa* is confined to the fresh fruit, poisoning by such means would be limited to seasons at which the plant is in bearing. Similarly, species of *Acacia* and *Albizzia* would vary in efficacy with seasonal variation in tannin content or with seasonal elaboration of sapotoxin.

The poison "Nero," which is gathered from mangrove-fringed and swampy foreshores, would be available only at drier portions of the years when its habitat is accessible. Foreknowledge of the more highly efficient plant material is shown in the almost exclusive employment of *Derris* and *Tephrosia* in certain localities, and in the preference for the sapotoxin-containing *Cupania* and of *Derris* species by the Cardwell natives. It would appear certain, however, that, in case of dearth of more potent material, plants of lesser efficacy were in many cases resorted to. It is noted that the less efficient poisons include *Acacia*, *Albizzia*, *Eucalyptus* species, *Pleiogynium*, *Sarcocephalus*, and *Terminalia*. *Acacia*, *Albizzia*, and *Eucalyptus* are of widespread and plentiful occurrence; *Pleiogynium*, *Sarcocephalus*, and *Terminalia* are abundant in localities. It is probable, therefore, that the ease of obtaining plentiful supplies has predetermined the adoption and use of some material. The comparative scarcity of the saponaceous fruit of *Castanospermum australe* would be unfavourable to its utilisation in fish-poisoning, though it may be surmised that its utility as a food would be similarly operative.

The recognised value of certain plants in furnishing food may, however, have led to the extension of their utility in the adoption of portions for the purpose of obtaining fish. The fruit of *Faradaya splendida* is edible; the bark constitutes a powerful and effective fish-poison. The fruit of *Barringtonia speciosa* is eaten in season in the Townsville district; the bark is valued for its effect on fish when introduced into suitable bodies of water. Similarly, the prepared rootstock of *Alocasia* is a food; the aerial part has been resorted to for the taking of the denizens of the streams. *Polygonum hydropiper* was also used as a food. The association of fish-poisoning property in certain plants with medicinal virtue is also noted. *Petalostigma quadriloculare* is employed in the Oaklands (Cairns) district as an antidote for opium; the bark of an

unidentified specimen as a stimulating or perhaps sedative medicine. *Asclepias curassavica* is regarded as possessing virtue as a love-charm in the Pennefather district. Medicinal property was also attributed to the leaves of *Careya australis*. The recognition of the superior efficacy of portions of certain plants for the purpose designed is evident. The bark alone of *Cupania pseudorhus* is utilised by the Cardwell and Hull River natives, and the experiments of the authors demonstrate the leaves to be non-toxic and saponin-free.

Similarly, the stem of *Derris uliginosa*, widely employed, is toxic, the leaves ineffective. The frequent preference for barks as fish-poisons may be surmised to be due to experience of their higher efficiency, as would be expected from the storage therein of excretory products of a toxic nature. The use of the roots of *Tephrosia rosea* in the Mapoon locality to the exclusion of the aerial parts cannot, however, be accounted for on similar grounds, as both root and stem are, according to the authors' trials, equally efficacious.

The recorded differential use of certain plants or parts of plants in fresh or salt water is not readily explicable. There is no reason, in the nature of the toxic principle involved, for the restriction of the employment of *Derris uliginosa*—which is elsewhere used indiscriminately—by the Cardwell natives to fresh waterholes; nor is it apparent why, as stated by James Murrell,³ the bark of the stem of the "broad-leaved apple-tree" ("Barkabah") was used in fresh water and the bark of the root in salt. The repeated statements of correspondents that a material was utilised either in fresh or salt water, or only in one or the other, would indicate that such a differentiation was clearly drawn, and the statement "No good in salt wata, he grow there, earn kill fish!" though obviously logically at fault, furnishes, nevertheless, an instructive example of aboriginal reasoning. E. J. Banfield, however, informs us that the poisons *Derris uliginosa*, *Faradaya splendida*, and *Careya australis* were used at Dunk Island almost solely in salt water, for, except for the eel, the fish in freshwater pools are too insignificant even for the blacks. Neither is the reason of the special method of preparation recorded for *Cupania pseudorhus* (baking in the native oven), or of such procedure as rubbing the bark of *Faradaya splendida* on heated stones, obvious. The nature of the active principle does not permit of elaboration by such means, which had originally perhaps only ceremonial import. The method of application is universally in Queensland by infusion in the habitat, the poison becoming active through subsequent absorption through the respiratory organs. The method consequently restricts the practice of the art to water of small dimensions; elsewhere it is not an infrequent custom to throw fragments of the more poisonous portions of the plant into the water, thereby inducing the fish to swallow them with fatal result. One such instance is to be found in the methods of the Bismarek Archipelago Islanders.⁴ The seeds of *Barringtonia speciosa* are ground and thrown into water, when fish snap at them and become stupefied.

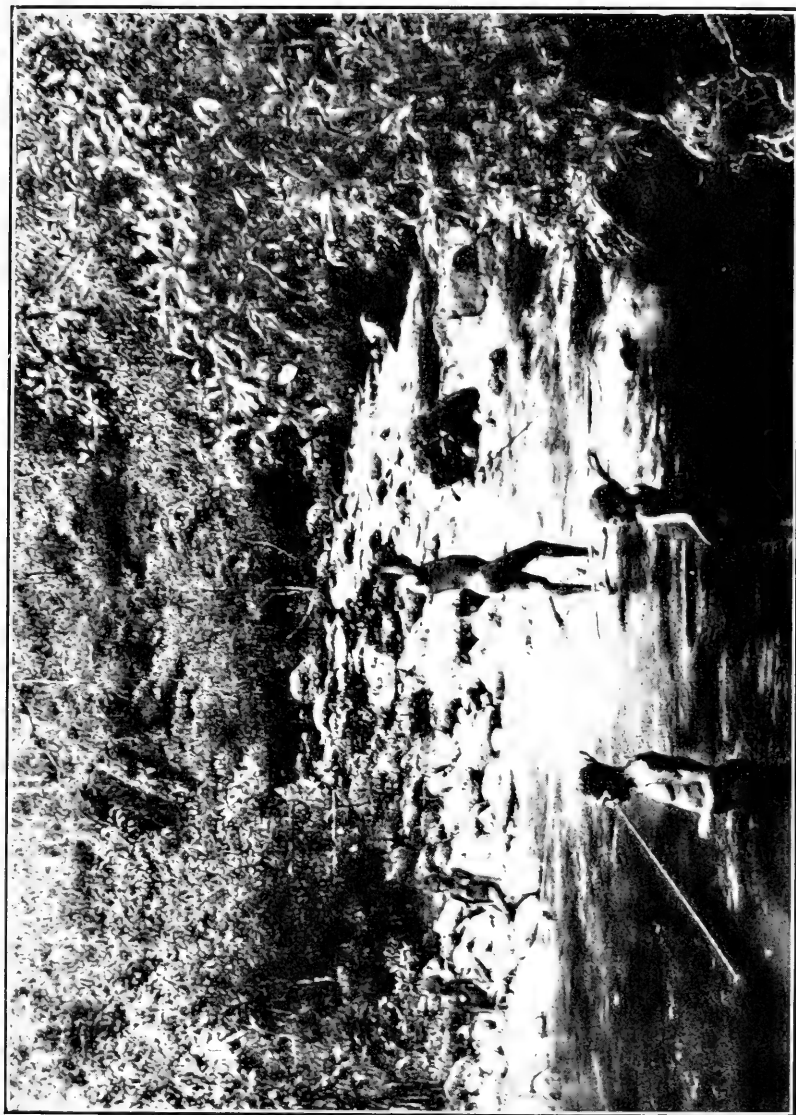
In the Gazelle Peninsula⁵ (Matupi) poisoning is effected by means of small fish whose stomachs are filled with vine-roots pounded; the larger sea-fish then take them and become intoxicated. Sometimes, as is the case in Samoa,⁶

³ Edmund Gregory, Narrative of James Murrell's Seventeen Years' Exile, &c., Brisbane, 1896 (1863).

⁴ Biro Lajos. Daten zur Schifffahrt und Fischerei der Bismarek-insulaner. Anzeiger der Ethnographischen Abteilung der Ungarischen National-Museums. Buda Pest 1905, p. 57.

⁵ R. Parkinson, Dreissig Jahre in der Südsee, 1907, p. 101.

⁶ George Brown, D.D., Melanesians and Polynesians, 1910.



NATIVES SPEARING FISH IN BABINDA CREEK, N.Q.

The creek is typical and suitable for the application of fish-poisons.

A. Atkinson, photo.

the natives add the poison to a palatable morsel, thereby ensuring a greater efficiency. Dr. Brown reports that *Tephrosia piscatoria* is thus mixed with taro, and the fruit of *Barringtonia speciosa* is used for the same purpose.

There would appear to be sufficient grounds for crediting to the aboriginal user some sense of the actual toxic property of his instruments rather than the attribution of their efficacy to magical influence. Codrington,⁷ writing of Melanesia, gives expression to the belief that native magicians attributed any noxious qualities which a poison might possess, not to its natural toxic principles, but to the magic charm which possessed the power of poisoning and which was communicated to it.

From the universality and dominance of belief in magic in aboriginal communities, we are not inclined to entirely exclude it as an actuating influence in fish-poisoning practice. The degree, however, to which the effects obtained was so attributed it is not possible to say. Nevertheless, there is certainly recognition of the specific influence of the plant in the instance vouched for by M. J. Colclough. Questioned as to why he supposed the fibrous stalk of the red-flowered water-lily (not obtained or identified by us), growing in profusion at Joe's Hole and Red Lily Lagoon at the head of the Roper River, affected fish, the native fisherman replied, "Sauey fella sit alonga that one, kill 'em fish, make 'em sick first time!"—from which is to be gathered the train of aboriginal reasoning.

A remarkable example of the distinction of natural poisoning from supernatural influence is found among the Narrinyeri tribe of the Lower Murray and Lakes Alexandrina and Albert. As E. C. Stirling points out, in contradistinction to the usual paraphernalia of "pointing sticks and bones" which were charmed or "sung," the "Neilyeri" was stuck into a putrefying corpse for two or three weeks and consequently acquired a special deadliness in use. There are few instances such as this of the direction of poison against fellow-man in Australia, and a similar practice observed by Dr. Herbert Basedow, whose observation is independently corroborated, may be cited. Among the Wogait and Ponga-ponga tribes on the Daly River, the vertebræ of large fish, principally barramundi, after insertion into decaying tissue, usually the putrid carcass of a kangaroo, for several days, were collected and tied to the head of a fighting-spear. This was done upon special occasions only, and the weapon was not allowed out of the owner's hand: with which the natives declared they could "kill quick fella!"

We can recall no parallel practices in Queensland; aboriginal familiarity with antidotal or remedial measures, however, is evident. The use of herbs as antidote for opium has been referred to, and M. J. Colclough relates the measures taken for treatment of snakebite. A native bitten by a venomous snake was seen cutting himself deeply with a shell knife, and tearing the flesh to induce copious bleeding, the while forcing the blood to run down his leg by energetic massage. The instance shows a knowledge, either intuitive or acquired, that is remarkable. The more recent adoption, by contact with civilisation, of poisoning practice is perhaps apparent in the "poison-carriers" collected by Bishop White (lately of Carpentaria) on the Roper River, and sent by him to the Queensland Museum. The donor, in explanation of their purpose, writes: "As near as I can remember the blackfellow told me their significance in the following words—'Man no likee, kill 'um poison his tucka, all the same white man!'" The specimens (231 mm. and 206 mm. in length) consist of the shaft of an ulna and shaft of a radius of

⁷ R. H. Codrington, D.D., *The Melanesians*, 1891.

the pelican, and would suffice to hold considerable quantities of poison, for the conveyance of which it is surmised they are adapted and in which they may have been employed.⁸

A similar object, a human shin-bone, in the Adelaide Museum Ethnological collection, and described as "found in blacks' camp (Lake Albert), and said to have been used for carrying a fluid poison," would indicate a well-defined toxicological knowledge, probably of earlier date.

The possible use of the "poison-carriers" as vehicles for the death-pointer is not, however, lost sight of. The only one, to our knowledge, extant is a "box" of pelican wing-feathers presented, we understand, by Roth to the Australian Museum, and is distinct in form from the specimen described.

METHODS AND MATERIAL.—Palmer,⁹ and later Roth,¹⁰ have published lists of fish-poisons in use among the aboriginal communities of portions of the eastern littoral and in the inland areas of North-West-Central Queensland and the Gulf of Carpentaria. These include many submitted as authenticated specimens to us. Our collection, however, covers some new ethnographic ground, and further has been treated from the aspect of actual effectivity as established by a series of physiological experiments with test fish.

For this purpose Trout Gudgeon (*Krefftius adspersus* (Castelnau)), Fire-tail (*Austrogobis galii*, Ogilby), Sunfish (*Mcclanotenia nigrans* (Richardson)), of Southern Queensland freshwater streams, have been utilised, and, for the distinction of poisons exhibiting markedly certain and rapid action from those of less well-defined toxic property or of tardy and uncertain effect, infusions of an arbitrary concentration of one part plant material in one thousand parts of water have been employed. The determination of actual effectivity would seem to us to have ethnological importance in its bearing upon the question as to whether adoption of certain material was dictated by certainty of its potency or by a faith rather in efficacy of the practice as such.

The reliability of deduction as to general efficacy from the premise of observed effect is, we judge, not absolute on more than one ground: the effectivity of air-dried and stored specimens, with which the experimental work has been conducted, may have undergone considerable diminution: certain varieties of fish other than those employed may be more susceptible to the poisonous effects of some plant materials (Hanriot so differentiates for *Tephrosia*), and seasonal alteration may account for diminution or disappearance of activity. The last-mentioned probability, though warranting assumption of greater potency during period of greater elaboration or storage of toxic principle, invests, still, the material with unreliability in use.

The collection of a series of authenticated fish-poisons has presented opportunity for chemical examination as to the nature of the toxic principles involved in their action. Question has recently¹¹ been raised in connection with the Sierra Leone fish-poison, *Pentaclethra macrophylla*, as to the efficacy of tannin (of which the specimen was found to contain 7.1 per cent.) as a piscicide. Our experiments show marked physiological disturbance and ultimate death of fish in solution of tannic acid (Mercks pure) of 1 in 10,000 concentration, and infusions of one part of the common tannin agents, Myrobalans and Valonia, in

⁸ R. Hamlyn-Harris, Abstract of Proceedings, Roy. Soc. Q., vol. 27, 1915.

⁹ E. Palmer, Notes on some Australian Tribes, Journ. Anthropol. Instit., vol. 13, 1884, p. 321.

¹⁰ W. E. Roth, North Queensland Ethnography, Bull. 3, 1901, p. 19.

¹¹ Bull. Imperial Inst., vol. xiii., No. 1 (1915), p. 47.

3,000 parts of water. This in conjunction with the slow effectivity of *Terminalia sericocarpa* (8 per cent. tannin) and *Eucalyptus* species (6 per cent.) in which no other principle likely to be toxic could be discovered, and the innocuity of material free from tannin, warrants us in the conclusion that materials containing tannin in relatively small percentage are efficacious in use but that their efficacy depends on their employment in relative abundance, as indeed is indicated by the notes of observers relating to the use of *Eucalyptus* and *Acacia* species.^{11a}

The identification of sapotoxin as the active principle of *Careya*, *Cupania*, *Faradaya*, and *Garcinia*, of derrid in indigenous *Derris* species, and the indication of tephrosin in *Tephrosia rosea* and *T. purpurea*, serves to indicate the extreme potency of these materials, here as elsewhere due to these principles, and is presented also as a contribution to the pharmacology of the indigenous flora.

Our observations lead us to adopt a classification, based on efficiency, of the fish-poisons investigated by us, as follows:—

GROUP A.—*Effective and rapid in action at great dilution.*—*Derris*, *Tephrosia*. *Pongamia*, “*Nero*,” containing active principles associated with ether-soluble resins. The sapotoxin-containing *Careya*, *Cupania*, *Faradaya*, *Garcinia*.

GROUP B.—*Poisons of intermediate effectivity.*—*Barringtonia speciosa*. *Stephania hernandifolia*, alkaloid-containing.

GROUP C.—*Poisons of lesser effectivity.*—Slow in action at higher concentrations or uncertain in action. *Acacia*, *Albizzia*, *Eucalyptus*, *Thespesia*, *Terminalia*, *Polygonum*.

GROUP D.—*Reputed poisons, found innocuous.*—*Sarcocephalus*, *Pleio-gynium*, *Petalostigma*, *Alocasia*, *Asclepias* (?).

Identified species recorded elsewhere, not examined by us:—

Acacia salicina, var. *varians* (Maiden), N.S.W.;

Acacia falcata (Maiden), N.S.W.;

Acacia penninervis (Maiden), N.S.W.;

Acacia verniciflua (Lauterer), Bathurst;

Acacia salicina, Roth.

Adenantha abrosperma (Roth);

Bauhinia sp. (Ewart and Morrison), N.T.;

Barringtonia racemosa (Palmer);

Derris scandens (E. J. Banfield);

Eucalyptus resinifera (Roth);

Eucalyptus corymbosa (Mathews), Western Australia;

Galactia varians (Roth);

Luffa aegyptiaca (Palmer);

Melia composita (Roth);

Tephrosia astragaloides (Roth); and

Acacia auriculiformis (seeds), on the authority of G. F. Hill, Darwin.

^{11a} Greshoff (13) recognising the effectivity of tannin-containing materials, follows Claude Bernard in ascribing to tannic acid an astringent effect and interference with the function of the gills (p 35).

ORDER MENISPERMACEÆ.

STEPHANIA HERNANDIÆFOLIA, Walp.

“NJANNUM,” Nerang, Q.

The only record of the use of *Stephania hernandiæfolia* as a fish-poison is made by J. Shirley,¹² in the Nerang district. Of other members of the Order, *Anamirta paniculata*, Colebr., is a fish-poison in India (Watt. Greshoff)¹³; and *A. cocculus*, Wight, Arn. (usually regarded as a synonym), constitutes perhaps the most used material for the purpose in Malaysia.¹⁴

In test experiments, infusions of *S. hernandiæfolia* were found to be certain but comparatively slow in action; there is absence of the excitation produced with *Derris*, *Tephrosia*, and the saponin-containing *Cupania* and *Careya*. Furthermore, fish exhibit a tendency to remain in depths till death overtakes them; a condition not, it is supposed, tending to ready capture.

Rennie and Turner¹⁵ have separated picrotoxin from *Stephania*, and Bancroft¹⁶ found it to be rich in alkaloid. Separation of the alkaloid and of a supposed picrotoxin fraction, following the procedure of Rennie and Turner, showed the former to be rather slowly toxic at concentration 1:50,000; with the latter no physiological effect was observed. The alkaloid is probably the chief active constituent of the poison, and to alkaloids are ascribed the effectivity of the Cameroon fish-poisons,¹⁷ *Strychnos aculeata* and others.

ORDER GUTTIFERÆ.

GARCINIA CHERRYI, Bail.

G. cherryi is recorded by Roth¹⁸ as a Queensland aboriginal fish-poison, and samples have been obtained by us through the courtesy of D. J. Mocatta, of Atherton.

Our experimental results show a high efficiency and rapidity in use, the bark being more potent than the leaves. The plant is highly sapotoxic; aqueous infusions show extreme frothing power, and the watery extract of the bark slowly hæmolyses blood corpuscles at a dilution of 1:50,000.¹⁹ A lesser saponin content is indicated for the leaves.

¹² J. Shirley, A Fish-poison of the Aborigines, Proc. Roy. Soc. Q., vol. ii., pt. ii., 1896, p. 89-91.

¹³ M. Greshoff, Beschrijving der giftige en bedwelmende planten bij de vischvangst in gebruik (Batavia 1900).

¹⁴ Tenison-Woods, Rev. J. E., Fisheries of the Oriental Region, Proc. Linn. Soc. N.S.W., vol. iii., 1888.

¹⁵ Rennie, E. H., & E. F. Turner, On the Poisonous Constituents of *Stephania hernandiæfolia*, Walp., Trans. & Proc. Roy. Soc. Sth. Aust., vol. 17, 1892-3.

¹⁶ Thos. L. Bancroft, Preliminary Notes on the Pharmacology of some new Poisonous Plants, Proc. Linn. Soc. N.S.W., vol. iv., 2nd series, 1889.

¹⁷ E. Fickendey, Zeit. Angew. Chem., vol. 23, p. 2166-7, Chem. Abstracts, vol. 5, 1911, p. 2901.

¹⁸ Roth, W. E., Food, its Search, Capture, and Preparation, North Queensland Ethnography, Bull. No. 3, 1901, p. 19.

¹⁹ In the statement of hæmolytic power, the figures 1:5,000, for instance, mean that blood corpuscles are hæmolysed in suspension in a liquid infusion of plant material diluted to that strength. Thus the result reported is observed on addition of .5 c.c. of 1 in 500 infusion to 4.5 c.c. of 1 per cent. suspension of corpuscles.

ORDER MALVACEÆ.

THESPESIA POPULNEA, Corr.

A less effective fish-poison of the Normanton district, where it is vernacularly known as "Mangrove Apple," "Mangrove Pear," or "White Mangrove." We have demonstrated its ability to cause stupefaction and death of fish at higher concentrations.

ORDER BURSERACEÆ.

CANARIUM AUSTRALASICUM.

"KAME," Batavia River.

"TCHALU-JI," Bloomfield River

(Comprehensive Catalogue of Queensland Plants).

The use of the wood of *Canarium* species as a fish-poison is reported elsewhere (*Greshoff*). A specimen of bark and leaves of *C. australasicum* forwarded as a fish-poison from Darwin by G. F. Hill, however, appeared to have no marked physiological effect on fish immersed in its infusion.

ORDER SAPINDACEÆ.

CUPANIA PSEUDORHUS, A. Rich.

"GILLIBUDGEN," Cardwell Dist., Q.

"KIRIBAN," Hull River, N.Q.

C. pseudorhus is a small tree growing to the height of twenty feet in scrubs along the banks of freshwater creeks and in forest country adjoining scrubs in the Cardwell district. The tree is said to be not plentiful, but its bark is an effective poison in either fresh or salt water and has a great reputation among the natives (*S. Creedy*).

J. M. Kenny, writing from the Hull River, states: "The bark is carefully scraped from the tree trunks and limbs and cooked in native ovens for about half an hour; then, when taken and put into a pond and well mixed in the water still held in dilly-bags, soon acts on the fish."

Maiden²⁰ writes: "It is stated that the aborigines used the pounded bark to stupefy fish in waterholes. It is a native of the north-east of N. S. Wales. and is also found in Queensland."

The bark is a rapid and powerful piscicide, producing excitement, stupefaction, and paralysis, and, in concentration 1:1,000, death in less than one hour. An infusion of the leaves was found to exercise no notable physiological effect, and the preference of the natives for the bark appears well founded. An infusion of the bark shows the characteristic sapotoxin reaction of frothing at an extreme dilution of 1:10,000, and hæmolyses blood corpuscles at a concentration of 1:14,000. The saponin obtained by extraction with hot 80 per cent. alcohol and deposition on cooling, with subsequent purification by solution in chloroform, gave the characteristic cherry-red colouration with concentrated sulphuric acid, but had preserved neither frothing nor hæmolytic power. The leaves were proved saponin-free.

Cupania sp. are listed by Greshoff as cyanophoric plants.

²⁰ General Report of the Sydney Intern. Exhibition of 1879. J. H. Maiden: Fish Poisons of the Australian Aborigines, *Agricultural Gazette*, N.S.W., 1894.

ORDER ANACARDIACEÆ.

PLEIOGYNIUM SOLANDRI, Engler.

This plant is known at the Proserpine as the "Burdekin Plum," and is referred to as one of the lesser important fish-poisons of the district. The inner layer of the bark is used, being scraped off, pounded, and put into a bag or net, which is thrown into the pool.

Except in considerable concentration, when the material would appear to function as a temporary stupeficient, no physiological effect was obtained in test experiments. The bark is tannin-free.

ORDER LEGUMINOSÆ.

(DERRIS ULIGINOSA, Benth.

"BUGGERA-BUGGERA," Ingham, N.Q.

"PUCKERA," Halifax, N.Q.

"MURRI" (MURI), Rockingham Bay, N.Q.

"BAGGARA," Dunk Island, N.Q.

"URUM," O'Connell River, N.Q.

This vine constitutes one of the most effective and rapid fish-poisons. On the O'Connell River the plant is disintegrated, placed in nets, and infused into the water of small lagoons.

Inspector Sweetman, of Townsville, supplies the following information concerning its use in the Ingham district:—"The vine is cut up into two-foot lengths, sticks of about a finger's thickness being preferred. They are beaten and bruised and handfuls thereof taken and thrown into the water, where they are again beaten and worked about. Fish quickly stupefy and, rising to the surface, are easily caught or speared.²¹ The method is only practicable in

²¹ Spearing was mostly accomplished by "Muttock," a four-pronged spear about eight feet long. These prongs were made of hardwood from eighteen inches to two feet long, about a quarter of an inch in diameter at the thick end and gradually tapered off to the point. These would be fitted into a dry but strong and firm grass-tree which was usually grown straight, but if it happened to be a little out of plumb the blackfellow would wet it well, and after it had soaked a bit into the wood he would hold it over the hot ashes until it steamed, and would place it sideways in his mouth, hold it across his teeth, and with a hand on each side lever the stick; this he would repeat several times until he got it straight. That performance over, he would take the stalk of the leaf of the cabbage-tree palm, split away the outer portion which he would retain, and with the aid of a stone shell, or his nails, if he could not get a knife or a bit of glass, pare it down until he secured the proper consistency, and as the grain runs straight, the width, generally about a quarter of an inch, would easily be obtained. This he would bind tightly around each end of the grass-tree for about one or two inches to prevent it splitting, and seal it over with grass-tree resin made into a gum-cement. He would then get a piece of hardwood, not so wide as his grass-tree and about six inches long, fit it in the ground, then sit down holding the stick between his feet, then reverse the grass-tree on to the point of the stick, give a few twirls, rotatory, and quickly make a hole large and deep enough to hold the prongs. Each prong would then be heated and rubbed over with the gum, and then the whole four would be fixed up, the points being kept about two or three inches apart with small pieces of wood, then bind all together with the cabbage-tree tape. Each prong would be fitted with a strong, sharp, bone point. (T. Illidge.)

comparatively small waterholes. It is useless in running water, and acts better in fresh than in salt."

Specimens of a similar vine have been received from W. C. Minniss, Mabuiaig Is., Torres Strait, under the native name "Sagee." It has there the reputation of an effective and rapid poison, the stem only being used, and has been identified by C. T. White as a species of *Derris*. While the specific naming has not been possible, we are assured of its identity with *uliginosa*, which is plentifully distributed on the mainland and islands.

A *Derris* has been received from Whitten Bros., Samarai, Papua, as a fish-poison locally known as "Wild Dynamite."

Derris uliginosa has also been forwarded by J. S. Bruce from Murray Island, where it is known as "Sud."²² The material was taken to lagoons on the reef in small bundles (at low water), and, after beating up with stones, immersed till the water became milky. The fish, forced from their holes, came to the surface stupefied. Mr. Murray reports that since the advent of hook and line the practice has fallen into disuse.

According to Maiden the plant is used for fish-poisoning purposes in many tropical countries.

The experiments of the authors confirm the extreme utility and effectiveness of the plant as a stupefacient. The test fish, first evidencing considerable excitement, rapidly became stupefied and periodically rose to the surface. An infusion of one part of dried stem in one thousand parts of water proved fatal in under an hour. The rapidity of action, it may be surmised, has earned for the plant the name of "Wild Dynamite" among the natives of Dunk Island.²³

DERRIS KOOLGIBBERAH, Bail.

"GERRENI," "Poison Rope," Edmonton, N.Q.

A scrub vine similar to *Derris uliginosa*, which it simulates in action, and in test experiments proved almost equally effective.

Greshoff records the use of various species of *Derris* as fish and arrow poisons in the East, ascribing the activity of *D. elliptica* to a resinous body, derrid—soluble in alcohol, ether, chloroform, and amyl alcohol, and sparingly soluble in water and potash solution.

Derrid is characterised by Hartwich and Gieger²⁴ as giving a blood-red colouration with concentrated sulphuric acid containing a trace of ferric chloride.

Pure derrid, isolated from *D. elliptica*, has since been described by Sillevold,²⁵ who assigns to it the formula $C_{33}H_{30}O_{10}$ and melting point $73^{\circ}C$.

The Identification of Derrid in D. uliginosa and D. koolgibberah.

The ether-soluble resin of both *D. uliginosa* and *D. koolgibberah* proved completely soluble in alcohol, chloroform, and amyl alcohol, and strikes a brown colour with concentrated sulphuric acid, and blood-red with sulphuric acid and ferric chloride.

²² Haddon, A. C., "Hunting and Fishing" Reports, Cambridge Anthropological Expedition to Torres Straits, vol. iv., 1912, writes of this as "Sad."

²³ Banfield, E. J., *The Confessions of a Beachcomber*, 1908, p. 269.

²⁴ Hartwich and Gieger, *Archiv. Pharm.*, 1901, vol. 239, pp. 491-505; *Abs. C.S.J.*, 1902, vol. 82, pt. i, p. 114.

²⁵ *Vide* Hanriot, *Comptes Rendues*, 1907.

Purification by removal of soluble material in dilute potash solution and re-resolution of the residue in large volumes of water, whence it was obtained by shaking out with ether, yielded a white waxy body giving the characteristic colouration with sulphuric acid and ferric chloride and melting at 68°-72° C. The purified compound is extremely toxic; a concentration calculated at 1 part in 3,000,000 proved rapidly fatal to test fish. Greshoff states his material to be effective at 1:5,000,000.

The presence of saponin is also indicated in *D. koolgibberah*. An infusion of 1:80 concentration slowly hæmolyzed a suspension of red corpuscles.

TEPHROSIA ROSEA, F. v. M.

“TE-UMA” of Mapoon and Pennefather River natives.

This shrub is one of the most effective poisons used in Cape York Peninsula.

The use of *Tephrosia* species has been almost universal. Among ten different species of fish-poisons used in the Oriental region two are common to Queensland, viz., *Derris uliginosa* and *Tephrosia*.²⁶ Among the North American Indians certain roots were used (that of a species of *Tephrosia* most commonly) “so that the stupefied fish could be secured by means of bows and arrows” (*Speck*).²⁷ *Tephrosia vogelii*, Hook., is used with effect in Rhodesia,²⁸ and the use of *T. toxicaria* and *T. periculosa* is referred to by Greshoff.

Tephrosia purpurea, Pers., the “Etu-Marù” of the Torres Strait natives, has been forwarded to us from Mabuig Island by W. C. Minniss, who states that the whole plant is employed. It is surmised that the plant, being indigenous to Queensland, was probably also used here, though we have no record of the fact. *T. astragaloides*, H. Brown, is referred to by Roth as employed in the Cloncurry and Upper Flinders River districts.

Two species of *Tephrosia* have been observed in use in the Northern Territory. A specimen in the Adelaide Museum is marked *T. lamproloboides*, and comes from that indefatigable collector and observer, T. Foelsche. *T. purpurea* is referred to by Ewart and Morrison in their “Flora of the Northern Territory.”²⁹ In the Territory, however, the art would appear to have been restricted in its application. M. J. Colelough informs us that he saw no poisons in use along the coast in the Roper River district, where the country is crossed by running streams but pools are at a discount. Here fish are obtained in shallow water by spearing, and in deep water the natives not only spear but resort to the use of fish-traps with a funnel-shaped entrance or drive at the mouth. In localities where from the presence of pools poisoning might be resorted to, the danger of crocodiles eating the catch limits the practice.

Neither Stirling nor Baldwin Spencer makes any mention of the use of poisons as far south as Central Australia. The former, in a letter to one of the authors, states “that he has never heard of the custom in the MacDonnell Ranges, where, from the localised and restricted conditions of the waters, it might be practicable. The natives there do, however, poison with pituri (*Duboisia hopwoodii*) the water where emus drink.”³⁰

²⁶ Tenison-Woods, Rev. J. E., Proc. Linn. Soc. N.S.W., vol. iii., 1888.

²⁷ Vide Handbook of American Indians, Bureau Amer. Ethn., Bull. 30, “Poisons.”

²⁸ Investigations of Vegetable Drugs and Poisonous Plants, Bull. Imp. Institute, vol. 13, No. 1, 1915, p. 28.

²⁹ A. T. Ewart & A. Morrison, Contributions to the Flora of Australia, No. 21, Proc. Roy. Soc. Victoria, vol. 26, pt. i., 1913.

³⁰ E. C. Stirling, Anthropology, Horn Expedition, 1896, vol. 4, p. 52.

The experiments of Hanriot dealing with the action of tephrosin, the poisonous principle of *T. vogelii*, show that "when a fish is placed in a dilute solution it shows great excitement at first but soon becomes quiet. The fins lose colour and become paralysed and the fish turns over and eventually dies." Our experimental results with *T. rosca* and *T. purpurea* are in agreement except that no paling of the fins could be observed. The action is extremely rapid.

The Occurrence of Tephrosin in T. rosca and T. purpurea.

Hanriot has isolated from *T. vogelii* a poisonous principle, tephrosin (M. Pt. 187° C.),³¹ a volatile oil, tephrosal, and an uncharacterised yellow body; and more recently his results have been confirmed on material from Rhodesia in the laboratories of the Imperial Institute. Experimental work on *T. rosca* and *T. purpurea* demonstrates the presence of probably identical bodies in these species. Following substantially the method of Hanriot, extraction with alcohol and distillation of the extract in steam, a pungent yellow oil passed over which is thought to be identical with tephrosal. The evaporated residue is treated with chloroform, and the chloroformic solution precipitated with ether. Resinous bodies are removed by agitation with aqueous alkali, and the ether-chloroform solution evaporated. The residue was found to be yellowish and hemi-crystalline, and the residue from evaporation of acetone solution is also markedly crystalline; the crystals being associated with a yellow body from which it was impracticable, with the material available, to completely separate them.

Concerning the toxicity of the final product there can be no doubt; a concentration approximately 1:1,000,000 proved fatal to test fish in half an hour.

PONGAMIA GLABRA, Vent.

The plant is recorded by Roth as a Queensland native fish-poison as follows:—"After being roasted, the roots are beaten upon a stone, tied in bundles and thrown into the water which turns somewhat greenish; it is put in of an evening and left there all night."

Botanically allied to *Derris* and *Piscidia*—the latter given as a fish-poison by Greshoff—its action is rapid and effective, the leaves being only less potent than the root. The active principle is found to reside in the ether extract of the root, and may be identical with or allied to the pachyrhizid, timboine, and tephrosin of other leguminous plants. Its failure to give a blood-red colouration with sulphuric acid and ferric chloride distinguishes it from derrid of genus *Derris*.

ALBIZZIA PROCERA, Benth.

A. procera was received by us through Sergeant Geary, described as an *Acacia*, from the Proserpine district, with the statement that the inside of the bark alone is used. The specimen did not prove certainly effective, the physiological effect being slight. Lauterer³² and Bancroft³³ have, however, pointed out the transitory nature of the occurrence of saponin in the plant, and in certain *Acacias*, and at seasons more positive results would probably have been obtained. It is scarcely credible, though, that the aboriginal could distinguish periods of maximum effectivity, and *Albizzia* would probably in his hands constitute an uncertain instrument.

³¹ Bull. Imp. Institute, vol. 13, No. 1, 1915.

³² Joseph Lauterer, Occurrence of Saponin in Australian *Acacias* & *Albizzias*, Proc. Roy. Soc. Q., vol. 12, 1896, p. 101-7.

³³ T. L. Bancroft, On the Discovery of Saponin in *Acacia delibrata*, Cunn., Proc. Roy. Soc. Q., vol. 4, 1887, p. 10.

ACACIA SP.

“ WAKA,” Normanton, N.Q.

Greshoff records the use of *Acacia* and allied genera as fish-poisons in Burma and elsewhere, and Maiden mentions three species of *Acacia* as so used, viz.:—*Acacia fulcata*, Willd., “ Wee-Tjellan”; *Acacia penninervis*, Sieb.; *Acacia salicina*, var. *varians*.

Brockmann, in his “Report on the Exploration of North-West Kimberley,” says of the natives: “ With the coarse grass and wattle-bark they make what looks like an enormous straw bottle; the inside of this they fill with the bark obtained from the root of a shrub which grows along the banks of the rivers, and which is known on the Fitzroy as ‘Majalla,’ and then drag it backwards and forwards through the pool, the result being that the fish become stupefied and come to the surface, and they are easily caught. Whether the stupefying effect is due to the bark or to the stirring-up of the mud Dr. House does not know; probably both are factors in the case.”³⁴

Our own experiments with water muddied with suspension of clay show that such factor, beyond inducing slight abnormality of behaviour, is inoperative. Mr. T. Welsby, indeed, in his book on “ Schnappering” (Brisbane, 1905), makes reference to a native mode of catching fish by muddying water with a greasy greyish-blue clay, and driving towards a specially prepared dam, when, rising gasping to the surface, they were taken. With the experience of the non-effect of mere “ muddying,” however, we are inclined to attribute the apparent success of the practice rather to the mechanical disturbance due to the invasion and beating of the water by the large number of fishermen. Similarly, in the occasionally observed mortality among fish in turbid flood-waters, the muddiness must be considered an insignificant contributing factor, the true cause probably lying in de-oxygenation of the stream waters by washing in large quantities of oxygen-absorbing material.³⁵ In the instance quoted the use of wattle-bark may have had an adjuvant effect, though the “ Majalla” must probably be regarded as the effective substance.

Certain species of *Acacia* are known to be rich in tannin and to be saponin-containing, the development of the latter occurring principally in the seeds and pods.³⁶ Greshoff states that the species likely to be most effective are those rich in tannin and bearing saponaceous seed-pods. The specimen contained 3 per cent. of tannin, and had but slight physiological action at concentration 1:1,000.

ORDER COMBRETACEÆ.

TERMINALIA SERICOCARPA, F. v. M.

DAMSON PLUM, Proserpine District.

Test experiments demonstrate the bark of *T. sericocarpa* to be a fish-poison of lesser effectivity, producing death in sufficient concentration. *T. laurinoides* and *T. tomentosa*, on the authority of Greshoff, were used for the purpose elsewhere (Liottard, Elliot Watt). No toxic principle other than tannin, of which 8 per cent. is present, could be demonstrated.

³⁴ Brockman, F.S., Report on Exploration of North-West Kimberley, 1901, Perth 1902 Extract from Appendix C by F. M. House, p. 18.

³⁵ Vide Allgem. Fischerei Ztg. 35, 353-6, 373, 4; Chem. Abstracts, vol. vi., 1912, p. 903

³⁶ Seed-pods of an *Acacia* were forwarded by G. F. Hill from Darwin, N.T. (probably *A. holocarpa*). The material possessed slight hæmolytic power, and proved slowly fatal to fish in somewhat increased concentration.

ORDER MYRTACEÆ.

EUCALYPTUS MICROTHECA, F. v. M.

“JINBUL or KURLEAH,” Cloncurry, N.Q.

“COOLIBAR,” Normanton, N.Q.

A specimen has been submitted by Dr. C. Taylor, Normanton, with the following note:—“Coolibar branches and leaves are cut up small and left in water several days until totally discoloured and fish sicken; universally used.”

As indicated by the donor's note and by our test experiments the plant is slow-acting but efficacious—death finally ensuing—at considerable concentration. The use of *E. microtheca* or other *Eucalypti* is the subject of mention by Sir Thomas Mitchell,³⁷ Palmer,³⁸ and Walter Roth.³⁹ Palmer, speaking of the blacks of the interior of Queensland, says “the small branches of *E. microtheca*, the Coolibah or Flooded Box, are cut up and with the leaves are laid in water for several days to sicken fish; it is universally used for this purpose.” Roth refers to the use in the Cloncurry, Woonamurra, and Leichhardt-Selwyn districts, where he says “numerous leafy boughs and branches of ‘gum-tree’ are utilised for capturing fish.”⁴⁰ The whole camp of blacks, working at it, will start throwing these in first thing in the morning; during the day the water becomes darker and darker, and strongly smelling, until by the following morning at sunrise, when it is almost black, the fish all lie panting on the surface and are easily caught.

The notes infer the slow nature of the effects and the use in considerable quantities. The effect, indeed, is compatible with low content of tannin, of which our specimen was found to contain in the bark 6 per cent. It is probable that species of *Eucalyptus* were indiscriminately used.

ORDER MYRTACEÆ.

BARRINGTONIA SPECIOSA, Linn.

“ARROO,” Townsville District, N.Q.

The toxic properties would seem to be from recorded use of various parts dispersed throughout the whole plant, including the seed capsules. The Queensland natives use the bark and leaves, adopting similar methods to those described by Roth for *Barringtonia racemosa*. In the districts in and around Townsville the native name of the plant is “Arroo.” Here the fruit is eaten as food, and it is not a little strange that this should be so, in the face of the fact that the fruit of this very species is used for fish-poisoning in New Britain, as recorded by Dr. George Brown.⁴¹ Further, the islanders of the Bismarek Archipelago poison by means of the seeds of *B. speciosa*, which are ground and thrown into the water, the fish snapping at the fragments and becoming stupefied.⁴²

The inhabitants of the Mary Ann Islands use the same plant extensively,

✓ ³⁷ Thos. Mitchell, Expeditions to Australia, vol. ii., 1838, p. 24.

✕ ³⁸ E. Palmer, Notes on Some Australian Tribes, Journ. Anthropol. Institute, vol. 13, 1884, pp. 321, 2.

✕ ³⁹ W. E. Roth, N.Q. Ethnography, Bull. 3, 1901, para. 15, p. 19.

⁴⁰ W. E. Roth, Ethnol. Studies among N.W.C.Q. Aborigines, 1897, chap. v., The Search for Food.

✕ ⁴¹ George Brown, Melanesians & Polynesians, 1910, p.

✓ ⁴² Biro Lajos, Anz. Ethno. Abth. Ungarischen Nat. Museums, 1905.

and Alvin Seale⁴³ tells us "that in former times the natives caught and dried great quantities of fish by its means, a grand fishing fiesta being held at certain seasons of the year. The Spanish authorities, however, finding that this was depleting the waters by killing young as well as old, abolished the method in 1894. When the Americans took possession the law was considered obsolete. By chance I was present at the first of these fiestas that had taken place for seven years. Fully several hundred people took part in the fishing. An immense deep pool several hundred feet deep, a short distance inside the reef, was surrounded by a line of seines. At low tide about one barrel of this precious juice was poured into the pool. The effect was almost instantaneous; hundreds of fishes came gasping and struggling to the top of the water, where they were captured and killed by the natives. No ill-effects seemed to follow the eating of these poisoned fish."

Parkinson⁴⁴ records that in the island of St. Matthias the fruits of a *Barringtonia* species are used as floats for their nets, and although fish-poisons are known and used by the Gazelle Peninsula natives it has apparently not occurred to them to put the fruit to the same use as elsewhere. Fijians use the outer bark of the fruit for a similar purpose, so Seemann⁴⁵ tells us.

In our hands infusions of the bark proved effective and fairly rapidly acting. Initial extreme excitement with exaggerated movement of the gills appear predominant symptoms. The bark is alkaloid, saponin, practically tannin-free, and successive ether and alcohol extractions yielded innocuous infusions. The aqueous infusion of material, after exhaustion by ether and alcohol, proved readily toxic, but the nature of the active principle has not been ascertained.

CAREYA AUSTRALIS, F. v. M.

"MUSSIL" (MUSSAL), Cardwell District, N.Q.

"RAROO," Dunk Island.

"BARKABAH," Burdekin River, Q.

This well-known and effective fish-poison grows plentifully in forest country and along the foreshore of the Cardwell district, being known in the vernacular of the white man as "Cocky Apple" (*S. Creedy*) and as "Cockatoo Apple" at the Proserpine (*Sergt. Geary*). Its use is general in either fresh or salt water, but at Cardwell was resorted to when *Cupania* or *Derris* were unavailable. James Murrell mentions a differentiation on the Burdekin between the bark of the stem and bark of root for use in fresh or salt water. On Dunk Island, the bark at the base of the trunk and of the roots was macerated in the water in which fish were observed by being beaten with a nulla-nulla, the mass being thrown into the pool. Here also, on the authority of E. J. Banfield, the leaves were accredited medicinal virtue, being beaten and applied as fomentations.

The bark is saponaceous. Infusions show characteristic frothing at great dilutions, and hæmolyse at concentration 1:1,000. A separated sapotoxin fraction gave characteristic cherry-red colouration with concentrated sulphuric acid, but was devoid of hæmolytic power.

⁴³ Alvin Seale, Report of a Mission to Guam, Caroline Island; Occasional Papers, B.P.B. Museum, Honolulu, pt. ii., 1901, p. 61.

⁴⁴ Parkinson, R., Dreissig Jahre in der Südsee (1907), p. 326.

⁴⁵ Seemann, D., Flora Vitiensis 1865 (1873).

ORDER RUBIACEÆ.

SARCOCEPHALUS CORDATUS, Miq.

“OOLPANJE,” Mitchell River, N.Q.

“COOLIABY,” Cloncurry, Q.

As a food used by the natives of the Mitchell and Flinders Rivers, Palmer⁴⁶ mentions the fruit of *S. leichhardtii*, which is eaten raw. The bark of *S. cordatus* has been sent us from the Proserpine with a reputation as a fish-poison. *S. cordatus* appears to exert a slight and temporary stupeficient effect only in considerable concentration. The bark is pronouncedly bitter and contains a non-alkaloidal bitter principle or resin (*Bancroft*), and an alkaloid in very small quantity. Tannin is absent. *S. esculentus* has been stated to contain alkaloids (*see* Bull. Imp. Institute, vol. xiii., No. 1, p. 46), and Greshoff (*loc. cit.*) lists genus *Sarcoccephalus* as being alkaloid-containing.

ORDER EBENACEÆ.

DIOSPYROS HEBECARPA, A. Cunn.

“TULICAN,” Goongabee Tribe, Cape Grafton.

“KUB,” Torres Strait (*A. C. Haddon*).

Other species of *Diospyros* are toxic and the secretion of the fruit vesicatory. The use of the fruit is reported elsewhere as a fish-poison.⁴⁷ Relative to the properties and uses of the fruit of *D. hebecarpa* we are informed by Mr. Samuel Lyon, of Yarrabah, as follows:—“This large wide-spreading tree blossoms usually in September and October in North Queensland, and produces fruit which in its fresh condition has distinct toxic properties.”

Members of the Goongabee tribe pound it between two flat stones, the resulting pulp being then placed in a dilly-bag, which is swirled about in the selected creek (fresh or salt water). In fresh water “Tulican” turns the water yellow, in salt water red. As the fish become stupefied they rise to the surface and are usually removed with a spear. In spite of the caustic nature of the fruit the poisoning does not in any way appear to spoil the fish as an article of food. The juice of the fruit brought into contact with the skin produces blistering, and the natives in handling it exercise great care in consequence. The specimen of dried fruit received was devoid of vesicatory power and inefficacious as a fish-poison, which, indeed, was not expected, from the emphasis laid by our correspondent upon the necessity of fresh condition.

ORDER VERBENACEÆ.

FARADAYA SPLENDIDA, F. v. M.

“KOIE-YAN,” Dunk Island.

In forwarding the specimen, E. J. Banfield writes: “Portions of the vine (*sic*) are cut into foot lengths; the outer layer of the bark is removed and rejected, the middle layer alone being preserved. This is carefully scraped off and made up in shapely little piles on fresh green leaves. When a sufficiency is

⁴⁶ E. Palmer, Journ. Anthropological Institute, vol. 13, 1884, p. 317.

⁴⁷ W. E. Roth, N.Q. Ethnography, Bull. 3, p. 19.

⁴⁸ A. C. Haddon, Expedition to Torres Strait, vol. 4, p. 159.

obtained it is rubbed on to stones previously heated by fire. The stones being then thrown into a creek or a little lagoon left by the receding tide, the poison becomes disseminated, with fatal results to all fish and other marine animals."

Approached as to his opinion as to whether the use of specific portions of the plant was arrived at by accident or coincidence, "The Beachcomber," whose numerous contributions to Queensland Ethnology are of the greatest possible value, and who speaks from first-hand knowledge, states:—"I am fairly certain, from the mental qualities of the race, that most of its discoveries were accidental, though in the case of 'Koie-Yan' there must have been investigation. I am of the opinion that the crescent of the fish-hooks was evolved from the way in which a certain oyster-shell weathers on the beach, and that indeed Nature showed the several stages of the process of making, for I have found models of them all. Do not the inventions of the moderns prove the theory of evolution? With few exceptions each embraces gradual improvements on the original germ. In the case of most of the poisons it seems to me safe to believe that they result from the happy chance."

Dilute infusions of *F. splendida* are potent and rapidly acting. Agitation, subsequent stupefaction with approach to the surface, rapidly set in, and death supervened in as short a period as one hour. The active principle is saponin. Aqueous extracts show the characteristic foaming properties of saponin at extreme dilutions, and hamolysis of blood corpuscles at final dilution of 1:4,000.

ORDER ASCLEPIADEÆ.

ASCLEPIAS CURASSAVICA, Linn.

This plant, a native of the West Indies, is stated to have made its appearance in Queensland somewhere about thirty years ago, and its adoption as a fish-poison on the Don River (*Sergt. Donohue*) is consequently comparatively recent.

The infused dry specimens obtained by us had no marked physiological action in considerable concentration, except an apparent slightly stupefying effect. Trout gudgeon were observed to continually approach the surface. The use of the plant as a love-charm by Pennefather River district—the men being reputed to rub themselves with it in order to compel a return of regard—is of much interest.

ORDER POLYGONACEÆ.

POLYGONUM HYDROPIPER, Linn.

"BOORAGOLAH," Lower Flinders River, N.Q.

"TANGGUL," Pine River, Q.

T. Petrie⁴⁸ recalls the use of *P. hydropiper* as a fish-poison by the Pine River natives, and says that the plant was pounded up with sticks and then thrown into water, and the water stirred up with the feet. The use of *Polygonum* sp. in this capacity is widespread, and is noted by Greshoff on various authority.

⁴⁸ C. C. Petrie, Tom Petrie's Reminiscences of Early Queensland, dating from 1837, Brisbane, 1904, p. 73.

A species of *Polygonum*, probably *orientale*, was pointed out to C. Hedley as one of the plants which the Port Curtis (Queensland) blacks use in obtaining fish, and that when a quantity of it is pounded up and thrown into a waterhole it rapidly brings all the fish to the surface in a dying condition, without impairing their wholesomeness as food.⁴⁹ Palmer refers to the "Water-pepper" as a food, the stalk being roasted and peeled and the pithy heart eaten.

The plant was received from Ald. L. H. Maynard, of Bundaberg, as a local reputed poison, and was supplemented by specimens of *P. strigosum* and *P. minus*, collected for us by C. T. White. The last have not been recorded as used for the purpose. Mr. Maynard's accompanying note states: "I have seen the blacks in this district using it; they dry and powder it and scatter it on the surface of the water. It is used in small lagoons or small waterholes left in creeks during dry spells."

Used in somewhat concentrated infusion, the *Polygonum* species tested proved efficient stupeficients; the fins and tails became contracted and depressed, and death has been known to follow within four and a half hours. *P. hydropiper* proved most effective, stupefaction being pronounced in a period of four hours.

ORDER EUPHORBIACEÆ.

PETALOSTIGMA QUADRILOCULARE, F. v. M.

"CINCHONA" and "QUININE TREE," by the natives on the Burnett River.

The use of the fruit of this plant is attested by Mr. T. Illidge. His statement that follows is descriptive of the practice:—"Almost forty-five years ago I lived at Marlborough, some 60 miles north of Rockhampton, where at times they would be gathered together, blacks from the coast and the Mackenzie and Fitzroy Rivers forming a decent mob of about 200, and on these occasions they would have a fairly joyous time hunting fish and game and indulging in their native corroborees. It was on one of these occasions, when I was riding down Marlborough Creek, I came across about a dozen blacks at a waterhole a little separated from the main creek, into which a lot of mullet had evidently got during a 'fresh' in the river and were imprisoned. The blacks had some dilly-bags full and a lot of branches broken off a small tree bearing a great quantity of fruit locally called 'Emu apples,' of a yellow colour, and the fruit was intensely bitter. Bushmen used to mix some in their tea as an antidote to attacks of fever and ague, which were very prevalent in Queensland in those days. Well, the blacks smashed all the fruit with stones, and then, with the addition of a rather broad-leaf plant obtained in the scrub, a sort of narcotic and which I have seen the blacks smoking in lieu of tobacco, mixed up and thrown into the waterholes, and although I waited and watched some time without seeing any result I continued my ride, but on returning four hours later found the blacks with a good supply of mullet and garfish which they had strung on light twigs for carrying to camp."

It is notable, however, that the berries were used in conjunction with a narcotic plant, and it is not possible to definitely allocate the result witnessed by Mr. Illidge. So far as we have been able to observe, an infusion of the berries

⁴⁹ C. Hedley, Uses of Some Queensland Plants, Proc. Roy. Soc. Q., vol. v., 1888, p. 10.

has no more than a slight and transitory stupefying effect. Greshoff attributes to the fruit the property of a vermifuge. A specimen of *P. quadriloculare* has also been received through the courtesy of Mr. Bleakley, Chief Protector of Aborigines, from the Oaklands (Cairns) district, where an infusion of tea is used as an antidote for opium.

ORDER AROIDEÆ.

ALOCASIA MACRORRHIZA, Schott.



"NERO" (prepared for use).

The use of the large Arum, *Alocasia macrorrhiza*, has not hitherto been recorded as a fish-poison, and we are indebted to Mr. Edward Hart, of Kolan, for the information that he has seen it so used by the Monduran and Upper Burnett blacks. It is common on alluvial flats adjacent to watercourses. It must be regarded as of great general utility by the aborigine, for Roth and others mention that the rootstock is eaten after preparation, and the modern blacks regard the roots, crushed and heated, as a useful local application in syphilis.

Both rootstock and leaves proved ineffective to test fish even when infused in quantity. The leaves of *Alocasia macrorrhiza* are cyanophoric, but mere maceration and steeping does not bring about interaction of glucoside and enzyme even in long periods. The fish-poison *Ophiocaulon cissampeloides* of the Cameroons is effectual, according to E. Fickendey,⁵⁰ owing to its content of free hydrocyanic acid and cyanogenetic glucoside.

UNIDENTIFIED SPECIMENS.

"NERO,"

from Pennefather River, Q.

The vine yielding this rapid and effective poison was not identified by Roth, who refers to it by the native name, and the present specimens were unsuitable for botanical naming. Flowers and fruit for the purpose are difficult to obtain, as they are borne by the plants during the wet season, when its habitat in swampy foreshores is unapproachable:

⁵⁰ E. Fickendey, Z. Angew. Chem. 23, 2166-7.

Relative to its use Rev. N. Hey states: "This fish-poison is used only in salt or brackish water in conjunction with plentiful supplies of green-ants' nests (*Ecophylla smaragdina*, Fab.), which are calculated to tempt fish to the surface and, when they are stupefied, they are more easily caught." The vine is prepared by beating out and coiling in lengths about staves, the beating together of which under water causes the dissemination of the poison.

Experimental results demonstrate the great effectivity of the prepared plant; fish are rapidly paralysed and killed. The ether extract infused in water proved rapidly fatal to fish. The association of toxic property with ether-soluble resins suggests the affinity of the plant with the Leguminosæ, and the identity with a species of *Derris* is rendered certain by the blood-red colouration given by the extracted resin with concentrated sulphuric acid containing a trace of ferric chloride.

MANGROVE, from Normanton, Q. (unidentified).

The bark, which the natives strip from the trees, is said to cause fish to sicken quickly. Botanical identification has been impracticable, but identity with the Swamp Mangrove, *Barringtonia speciosa*, is suggested.

BARK OF ROOT (unidentified).

Mr. J. L. Bramford, of Oaklands *viâ* Cairns, the donor, states that the material is placed in waterholes overnight and fish are found dead on the surface next morning. The natives of the district also employ it as a stimulating or perhaps sedative medicine, and Mr. Bramford is of the opinion that its use accounts for the death of many small children, the infants pining away when the opiate (?) is indulged in by the mothers, who are with difficulty induced to abandon the habit.

Test fish placed in infusions of the material exhibited preliminary excitation, stupefaction, and finally death after long intervals. A slow but effective poison. An infusion of the alcoholic extract is similarly effective, but the nature of the active principle has not been determined.

A BARK (unidentified) from Oaklands *viâ* Cairns, Q.

The material is used similarly to the preceding "Bark of root," and with identical results. It would appear from test experiments to be in equal concentrations somewhat more potent, and the active principle is alcohol-soluble, but has not been further characterised.

AN UNIDENTIFIED SPECIMEN

From Dorothy Creek, Katherine River, Northern Territory (G. F. Hill,
Port Darwin).

A portion of shrub reputed to be used for fish-poisoning purposes on the Katherine River did not lend itself to botanical identification.

Mr. R. H. Teck-Brook (The Mine), to whom we are indebted for specimens, supplies the following information:—"It appears to grow only in the neighbourhood but not in the immediate vicinity of water; that is to say it grows, as far as I can see, only on the tops of rocky hills, but in the adjoining valleys there is water containing fish—at least the large holes in Dorothy Creek contain fish.

There is no trace that I can find of the shrub growing close to the creek itself. As far as I can see, the shrub has no seed, and I can find no trace of any seed. It is about four to five feet high, and the blacks scrape the bark off with a sharp stone and either pound it on another stone and then push it into the water, or else, after pounding and bruising the bark, they put it in a grass basket and drag the basket with the pounded bark inside through water and in five minutes the fish are floating on the top."

Its infusion, however, proved innocuous to test fish.

ACKNOWLEDGMENTS.

We desire to express our indebtedness to various donors and correspondents receiving mention in the text of this paper; also to Professor T. T. Waterman (Berkeley, Cal.), Messrs. C. Hedley (Australian Museum, Sydney), L. Glauert (Perth Museum), and J. W. Beattie (Hobart), for various information.

Our thanks are also due to Mr. C. T. White, Assistant Government Botanist, for botanical identification; and to the State Agricultural Chemist, Mr. J. C. Brünnich, for placing at our disposal facilities for the chemical examinations of specimens.

LIST OF AUSTRALASIAN AND AUSTRO-PACIFIC MURIDAE.

BY HEBER A. LONGMAN.

At the present time any worker on the Australian rodents has to face considerable difficulties owing to the need for searching through a very numerous series of articles in various publications. With the exception of the necessarily brief references in the Catalogue of Australian Mammals by J. Douglas Ogilby, published in 1892 by the Australian Museum, and the descriptions and illustrations in Lucas and Le Souëf's popular work, "The Animals of Australia" (1909), there have been no attempts to issue a consecutive list of our rodents. From time to time Oldfield Thomas, of the British Museum, has dealt with distinct groups, and thanks to the efforts of that well-known authority there has been a useful process of what may be termed "straightening out." It is hoped that later on some central expert will prepare a complete and comprehensive catalogue, but in the meantime the publication of a list with references may be welcomed. It has also been thought advisable to refer in some cases to associated literature apart from the purely systematic work. With a few exceptions, the writer has made no attempt to reprint generic or specific descriptions, as in the majority of cases abridgments are apt to be misleading.

The interest attaching to the Australian rodents has been dwarfed by the special prominence given to our marsupial fauna. Some of the earlier writers, indeed, looked upon the endemic rodents as being almost negligible. But the presence of such distinctive genera as *Hydromys*, *Xeromys*, and *Mastacomys* stultifies the old view, whilst the evolution of the characteristic Jerboa-like forms of the central districts offers a fascinating problem to students. The theory which associates our mammalian fauna with that of South America, through antarctic connections which linked the southern lands before the evolution of the more characteristically placental mammals, does not account for the existence of about fifty autochthonous species of rodents in Australia and Tasmania. Nor can these rodents all be disposed of as recent immigrants. The presence of several highly specialised marsupials in the north-eastern districts and in adjacent Pacific islands is another interesting factor. At present the biotal evidence, particularly when supplemented by that of fossil forms, is so complex that varying views may be emphasised by giving prominence to certain points. The problem is too great to be adequately dealt with here, but it may be noted that on herpetological evidence alone there are pronounced Australian affinities with Papua, Ceram, Timor, and several other East Indian Islands. When all the facts come to be critically marshalled, we may find the truer key to the origin of our mammals (marsupials as well as rodents) in northern land connections with continental associations in the past.

Occasionally rodents attract attention by their abundance, and the antipathy aroused by plagues of rats or mice generally results in a strenuous campaign of extermination. So far as Queensland is concerned, an article by E. Palmer, "Notes on a

great visitation of Rats in the north and north-western plain country of Queensland, in 1869 and 1870," may be referred to.¹ The rat was written of as an indigenous one, but is compared to *Mus decumanus*. The writer says that the numbers were almost incredible, and that "one rat to every ten square yards in each mile would not represent anything like their numbers." Spencer and Gillen, writing of the higher and lower steppes of the interior, state: "Rodents are far more abundant than the smaller marsupials, and in addition to the indigenous ones, the imported *Mus musculus* has now made its way into the Centre."² Lucas and Le Souëf give a remarkable account of migrating rats in Western Queensland and Central South Australia.³

The association of rodents and disease has brought forth a wealth of pathological literature—far too voluminous to note. A. Jefferis Turner (Pr. Roy. Soc. Qld., xxi, 1907, pp. 114-120) draws attention to the ominous connection between rats, fleas, and plague, and gives a local warning. Service Publication No. 5 of the Commonwealth of Australia Quarantine Service, by J. S. C. Elkington, M.D., D.P.H., contains a review of recent literature and work on the epidemiology of plague, and is of great value.

PALEONTOLOGICAL.—The remains found in Australian deposits are but very fragmentary, and of such a nature that little work has been recorded of them. Apart from a sub-fossil skull of *Hydromys* (indistinguishable from the present-day *H. chrysogaster*), there are only a few incomplete bones, specifically indeterminable, in the Queensland Museum collections, and these obviously come from recent deposits. *Mastacomys fuscus*, Thomas, has been recorded from the caves of Wellington Valley, N.S.W., by Lydekker, in conjunction with *Conilurus albipes* and "*Mus*" *lineolatus*.⁴ Broom refers to "innumerable remains of Bush Rats (*Mus* sp.) which I have not had an opportunity of identifying with certainty." (Wombeyan Caves, N.S.W.),⁵ and Ogilby notes that *Conilurus* (now *Leporillus*) *apicalis*, Gould, "has been found in a fossil state in the Pleistocene of New South Wales."⁶

Family MURIDÆ.

Subfamily HYDROMYINÆ.

Genus HYDROMYS, Geoffroy, 1805.

Specialised for aquatic life; toes partially webbed. Molar dentition reduced to two teeth on each side of each jaw. Prior to the description of the allied *Xeromys*, Oldfield Thomas regarded *Hydromys* as "one of the most singular and at the same time most isolated genera of Muridæ, . . ."⁷

¹ E. Palmer, Proc. Roy. Soc. Qld., ii, 1885, p. 193.

² Spencer and Gillen, "Across Australia," i, p. 103.

³ Lucas and Le Souëf, "Animals of Australia," p. 21.

⁴ British Museum Cat. Foss. Mamm., pt. i, 1885, p. 227.

⁵ Broom, P.L.S. N.S.W., xxi, 1896, p. 59.

⁶ Ogilby, Cat. Austr. Mamm., 1892, p. 116.

⁷ Thomas, P.Z.S., 1889, p. 247.

Hydromys chrysogaster, Geof.

- 1805.—*Hydromys chrysogaster*, Geof., Ann. Mus. d'Hist. Nat., vol. vi, p. 90.
 1863.—*Hydromys chrysogaster*, Gould, Mamm. Austr., iii, pl. xxiv.
 1887.—*Hydromys chrysogaster*, Windle (Anatomy), P.Z.S., p. 53.
 1887.—*Hydromys chrysogaster*, R. Collett, Zool. Jahr., p. 841.
 1889.—*Hydromys chrysogaster*, Thomas, P.Z.S., p. 247, pl. xxix, fig. 7.
 1892.—*Hydromys chrysogaster*, Ogilby, Cat. Austr. Mamm., p. 101.

Habitat : Eastern Australia and Tasmania.

Kreffit states^s that the black snake, *Pseudechis porphyriacus*, Shaw, is partial to "the young of the water-rat, *Hydromys leucogaster*. On one occasion sixteen young of this rodent were taken out of a specimen, so that the reptile must have plundered four nests." The writer's experience is that the adult rats are well able to take care of themselves, being very powerful and vigorous, so much so that a *Python variegatus*, over ten feet in length, after several attempts to tackle a large *Hydromys* put in its cage, gave up the contest, being severely bitten. In country districts the water-rat when in its natural surroundings is frequently mistaken by local naturalists for the platypus. It has been pointed out by Windle (loc. cit.) that the two halves of the lower jaw of this rat "are extremely movable upon one another, a quantity of fibrous tissue intervening at the symphysis so as to form a kind of fulcrum by means of which a scissors-like action of the extremely long inferior incisors is obtainable."

The following subspecies of *H. chrysogaster* have been described :—

Hydromys chrysogaster fulvolavatus, Gould.

- 1863.—*Hydromys fulvolavatus*, Gould, Mamm. Austr., iii, pl. xxv.
 1897.—*Hydromys chrysogaster fulvolavatus*, Collett, P.Z.S., p. 323.
 1908.—*Hydromys fulvolavatus*, Thomas and Dollman, P.Z.S., p. 790.

Type locality : River Murray, S.A. (Arnhem Land watercourses.—Collett.)

Hydromys chrysogaster reginæ, Thos. & Doll.

- 1908.—*Hydromys chrysogaster reginæ*, Thomas and Dollman, P.Z.S., p. 789.
 1909.—*Hydromys chrysogaster reginæ*, Thomas, Ann. Mag. Nat. His., 8, iv, p. 197.

Type locality : Burdekin River, N.Q.

Hydromys chrysogaster caurinae, Thomas.

- 1909.—*Hydromys chrysogaster caurinae*, Thomas, Ann. Mag. Nat. His., 8, iv, p. 197.

Type locality : Parry's Creek, near Wyndham, E. Kimberley, N. W. Australia.

Hydromys leucogaster, described at the same time as *chrysogaster* by Geoffroy St. Hilaire and illustrated by Gould in pl. xxvii of the "Mammals of Australia," vol. iii, is generally not considered as a distinct species, although Gould states that his specimens from the Hunter and Clarence Rivers were distinguished by their

^s Krefft, "Snakes of Australia," 1869, p. 46.

smaller and darker feet. Collett records⁹ an individual with intermediate colouring, and this variability is also borne out by Queensland Museum specimens. *Hydromys fulvo-venter*, Jourdain, 1837 (Ann. Sci. Nat. (2), viii, p. 372), should be referred, on the authority of Oldfield Thomas,¹⁰ to *H. chrysogaster*, and the *Hydromys lutrilla* "of Macleay" noted by Gould in his introduction to vol. i of the "Mammals of Australia" should probably be included in the same synonymy.

***Hydromys fuliginosus*, Gould.**

1863.—*Hydromys fuliginosus*, Gould, Mamm. Austr., iii, pl. xxvii.

1906.—*Hydromys fuliginosus*, Thomas, P.Z.S., p. 765.

Type locality : Perth.

This West Australian form should be regarded as a distinct species.

****Hydromys beccarii*, Peters.**

1874.—*Hydromys beccarii*, Peters, Mus. Civ., vi, p. 303.

1881.—*Hydromys beccarii*, Peters & Doria, Mus. Civ., xvi, p. 706, pl. xviii.

1897.—*Hydromys beccarii*, Thomas, Mus. Civ., xviii, p. 609.

Type locality : Key Island.

****Hydromys esox*, Thomas.**

1906.—*Hydromys esox*, Thomas, Ann. Mag. Nat. His., xvii, p. 324.

Type locality : Port Moresby, Papua.

Genus **XEROMYS**, Thomas, 1889.

Terrestrial, but dentition as in *Hydromys*. "External form murine. Tip of muzzle as in *Mus*, not as in *Hydromys*. Toes unwebbed. Tail scaly, very finely haired. Skull as in *Mus*, except that the supraorbital edges are rounded."

***Xeromys myoides*, Thomas.**

1889.—*Xeromys myoides*, Thomas, P.Z.S., p. 248.

1892.—*Xeromys myoides*, Ogilby, Cat. Austr. Mamm., p. 102.

Type locality : Port Mackay, Queensland.

Of this remarkable rodent Oldfield Thomas says (loc. cit.): "That *Xeromys* is the almost unmodified descendant of one of the more recent ancestors of *Hydromys* is almost unquestionable, as it does not possess a single peculiar characteristic of its own, every one of its points being present either in its relatives the true Rats and Mice, or in what we may fairly call its offspring, *Hydromys*."

The Philippine rat, *Xeromys* (?) *silaceus*, Thomas (Ann. Mag. Nat. His., vi, 16, 1895, p. 161), has since been placed in the genus *Celaenomys*, Thomas.

*Genus **PARAHYDROMYS**, Poche, 1906.

Less specialised for aquatic life than *Hydromys*.

****Parahydromys asper*, Thomas.**

1906.—*Limnomys asper*, Thomas, Ann. Mag. Nat. His., xvii, p. 325.

1906.—*Parahydromys asper*, Poche, Zool. Anz., Leipzig, 30, p. 326.

⁹ Collett, Zool. Jahr., 1887, p. 841.

¹⁰ Thomas, P.Z.S., 1908, p. 790.

NOTE.—Species not Australian or Tasmanian are denoted by an asterisk.

The name *Limnomys*, being preoccupied, was changed to *Drosomys* by Oldfield Thomas on December 31st of the same year (Proc. Biol. Soc. Wash., xix, p. 199), but in the meantime Poche had proposed *Parahydromys*, which name has thus a slender priority over that of the original describer.

Type locality : Mt. Gayata, Richardson Range, Papua.

*Genus LEPTOMYS, Thomas, 1897.

“Molars strictly *Hydromyine* in structure, but 3/3 in number.”

**Leptomys elegans*, Thomas.

1897.—*Leptomys elegans*, Thomas, Mus. Civ., p. 610.

Habitat : Papua.

*Genus CROSSOMYS, Thomas, 1907.

“A highly specialized aquatic form.”

**Crossomys moncktoni*, Thomas.

1907.—*Crossomys moncktoni*, Thomas, Ann. Mag. Nat. His., xx, 1907, p. 70.

Type locality : Serigina, Brown River, N. E. Papua.

Subfamily MURINÆ.

(1857. *Murinae*, Baird, Mamm. N. Amer., p. 434.)

The old method of incorporating about twenty Australian species in the genus *Mus* is now quite untenable. This genus, *sensu stricto*, can now be used only for the imported *Mus musculus*. The common black rat is now designated as *Epimys rattus*, and the brown rat, once familiar under the name of *Mus decumanus*, Pallas (1778), is also placed in Trouessart's genus *Epimys* with the specific name of *norvegicus*, Erxleben (1777).

The Australian and Papuan species may be enumerated as follows :—

Genus EPIMYS, Trouessart, 1881. Type—*Mus rattus*, L.

1910.—G. S. Miller, Pr. Biol. Soc. Wash., xxiii, pp. 57-60 ; Thomas, Ann. Mag. Nat. His., vi, p. 603.

Epimys assimilis, Gould. “Allied Rat.”

1857.—*Mus assimilis*, Gould, P.Z.S., 1857, p. 241.

1863.—*Mus assimilis*, Gould, Mamm. Austr., iii, 1863, pl. xv.

1887.—*Mus assimilis*, Collett, Zool. Jahrb., 1887, p. 838.

1892.—*Mus assimilis*, Ogilby, Cat. Aus. Mamm., 1892, p. 105.

1910.—*Epimys assimilis*, Thomas, Ann. Mag. Nat. His., vi, 1910, p. 605.

Habitat : From North-Eastern Queensland to South-Western Australia.

Epimys browni, Alston.

1877.—*Mus browni*, Alst., P.Z.S., i, p. 123 ; *ibid.* 743.

1878.—*Mus echimyoides*, Rams., P.L.S. N.S.W., ii, p. 14.

1881.—*Mus echimyoides*, Pet. & Dor., Mus. Civ., xvi, p. 699.

1897.—*Mus browni*, Thomas, Mus. Civ., xvii, p. 612.

1910.—*Epimys browni*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

1914.—*Epimys browni*, Thomas, Ann. Mag. Nat. His., xiii, p. 439.

Thomas notes (1897) that *concolor*, Bly., *ephippium*, Jent., *wichmanni*, Jent., *maorium*, Hutt., and *exulans*, Peale, are very closely allied with this species.

Type locality : Duke of York Island.

Epimys colletti, Thomas.

1904.—*Mus colletti*, Thomas, Nov. Zool., xi, 1904, p. 599.

1910.—*Epimys colletti*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Type locality : S. Alligator River, Northern Territory. "Dug out of hole in open clay flats."

Epimys culmorum, Thos. and Doll.

1908.—*Mus culmorum*, Thos. & Doll., P.Z.S., 1908, p. 790.

1910.—*Epimys culmorum*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Type locality : Inkerman, North-West Queensland. A common central species.

***Epimys exulans**, Peale. "Maori Rat" ; "Pacific Rat."

1848.—*Mus exulans*, Peale, U. S. Expl. Ex., Mamm., 1st edit., p. 47.

1848.—*Mus vitiensis*, Peale, U. S. Expl. Ex., Mamm., 1st edit., p. 49.

1877.—*Mus maorium*, Hutt., Tr. N. Z. Inst., ix, p. 348 ; loc. cit. x, p. 288 and xi, p. 344.

1895.—*Mus exulans*, Thomas, P.Z.S., p. 338.

1896.—*Mus exulans*, Waite, Mem. Aus. Mus., iii, p. 165, pl. viii. (with refs.).

1899.—*Mus exulans*, Hedley, P.L.S. N.S.W., xxiv, p. 408.

1904.—*Mus exulans*, Hutt., Index. Faun. Nov. Zeal., p. 347.

1910.—*Epimys exulans*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

1911.—*Mus exulans*, Oliver, Tr. N. Z. Inst., xliii, p. 537.

See note under *E. browni*.

Habitat : Pacific Islands.

Epimys fuscipes, Waterh. "Dusky-footed Rat."

1840.—*Mus fuscipes*, Waterh., Zool. Voy. Beagle, p. 66, pl. xxv.

1892.—*Mus fuscipes*, Ogilby, Cat. Austr. Mamm., p. 104.

1900.—*Mus fuscipes*, Waite, Rec. Aus. Mus., iii, p. 190, figs. 1-4.

1910.—*Epimys fuscipes*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Epimys lutreola, Gray, with the following references, should probably be included with the above :—*Mus lutreola*, Gray, Appen. Grey's Travels, 1841, p. 409 ; *M. fuscipes*, Gray, B.M.C., 1843, p. 111 ; *M. fuscipes*, Gould, Mamm. Aus., iii, 1863, pl. xi ; *Epimys lutreola*, Thomas, Ann. Mag. Nat. His., vi, 1910, p. 605.

Habitat : Southern half of Australia, Tasmania, and Bass Strait Islands. Found near water.

***Epimys gestri**, Thomas.1897.—*Mus gestri*, Thomas, Mus. Civ., xviii, p. 611.1910.—*Epimys gestri*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Type locality : Kapa Kapa, Papua.

Epimys greyi, Gray.1841.—*Mus greyi*, Gray, App. Grey's Trav. Aus., ii, p. 410.1887.—*Mus greyi*, Collett, Zool. Jahr., ii, p. 837.1892.—*Mus greyi*, Ogilby, Cat. Austr. Mamm., p. 108.1896.—*Mus greyi*, Waite, Horn. Exped., ii, p. 401.1898.—*Mus greyi*, Waite, Pr. Roy. Soc. Vic., x, 2, p. 124.1910.—*Epimys greyi*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Southern, Central, and North-Eastern Australia.

Epimys manicatus, Gould. "White-footed Rat."1857.—*Mus manicatus*, Gould, P.Z.S., p. 242.1863.—*Mus manicatus*, Gould, Mamm. Austr., iii, pl. xvi.1892.—*Mus manicatus*, Ogilby, Cat. Mamm. Austr., p. 105.1910.—*Epimys manicatus*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Type locality : Port Essington.

***Epimys mordax**, Thomas.1904.—*Mus mordax*, Thomas, Ann. Mag. Nat. His., xiv, p. 398.1910.—*Epimys mordax*, Thomas, Ann. Mag. Nat. His., vi, p. 605.1914.—*Epimys mordax*, Thomas, Trans. Zool. Soc., xx, p. 319.

Habitat : Papua and Dutch New Guinea.

***Epimys prætor**, Thomas.1888.—*Mus prætor*, Thomas, Ann. Mag. Nat. His., i, p. 158; & P.Z.S., p. 480.1910.—*Epimys prætor*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Solomon Islands.

***Epimys ringens**, Pet. & Dor., Ann. Mus. Civ., Gen., xvi, p. 700.1881.—*Mus ringens*, Pet. & Dor.1914.—*Epimys ringens*, Thomas, Tr. Z.S., xx, 9, p. 319.

Habitat : Fly River, Papua.

The later reference to *E. ringens* also contains a note on the "*Mus*" *ratticolor* of Jentink.**Epimys sordidus**, Gould.1857.—*Mus sordidus*, Gould, P.Z.S., p. 242.1863.—*Mus sordidus*, Gould, Mamm. Austr., iii, pl. xvii.1892.—*Mus sordidus*, Ogilby, Cat. Austr. Mamm., p. 106.1910.—*Epimys sordidus*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Darling Downs.

Epimys terræ-reginæ, Alston.1867.—*Acanthomys leucopus*, Gray, P.Z.S., p. 598.1879.—*Mus terræ-reginæ*, Alston, P.Z.S., p. 646.1892.—*Mus terræ-reginæ*, Ogilby, Cat. Austr. Mamm., p. 107.1910.—*Epimys terræ-reginæ*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Cape York.

Epimys tunneyi, Thomas.1904.—*Mus tunneyi*, Thomas, Nov. Zool., xi, p. 223.1908.—*Mus tunneyi*, Thomas, P.Z.S., p. 790.1910.—*Epimys tunneyi*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Arnhem Land, Northern Territory.

Epimys vellerosus, Gray.1847.—*Mus. vellerosus*, Gray, P.Z.S., p. 5. "Tawny Rat."1863.—*Mus vellerosus*, Gould, Austr. Mamm., iii, pl. xii ; queried with *fuscipes*, as a *lusus*.1892.—*Mus vellerosus*, Ogilby, Cat. Austr. Mamm., p. 104.1910.—*Epimys vellerosus*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat (Ogilby) : Plains between the Mary and Glenelg Rivers, S.A.

Epimys villosissimus, Waite. "Long-haired Rat."1863.—*Mus longipilis*, Gould (nec Waterh.), Mamm. Austr., iii, pl. xiii.1898.—*Mus villosissimus*, Waite, Pr. Roy. Soc. Vic., x, pt. 2, p. 125.1906.—*Mus villosissimus*, Thomas, P.Z.S., p. 537.1910.—*Epimys villosissimus*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Central Australia and Northern Territory.

Epimys woodwardi, Thomas.1908.—*Mus woodwardi*, Thomas, Ann. Mag. Nat. His., ii, p. 375.1910.—*Epimys woodwardi*, Thomas, Ann. Mag. Nat. His., vi, p. 605.Closely allied to *tunneyi*, Thomas.

Habitat : Lagrange Bay, N. W. Australia.

Epimys velutinus, Thomas.1882.—*Mus velutinus*, Thomas, Ann. Mag. Nat. His., ix, p. 415.1910.—*Epimys velutinus*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Habitat : Tasmania.

Hapalotis arboricola, Krefft. "Sydney Bush Rat" = *Epimys rattus*, L. The following are references to this form :—

1863.—*Hapalotis arboricola* (Macleay) Krefft, in Gould's Mamm. Austr., i, p. xxxv.1897.—*Mus arboricola*, Waite, P.Z.S., 1897, p. 859, with note by Thomas.1906.—*Epimys rattus*, Thomas, Ann. Mag. Nat. His., xvii, 1906, p. 84.

Collett (P.Z.S., 1897, p. 323) records *Epimys rattus rufescens* (Gray) from Arnhem Land.

Genus PSEUDOMYS Gray.

This genus is confined to Australia and Tasmania. Oldfield Thomas divides it into four sub-genera : *Pseudomys* (*sensu stricto*), *Thetomys*, *Leggadina*, and *Gyomys*. For purposes of convenience trinomials are not here used.

Subgenus PSEUDOMYS, Thomas.

Pseudomys australis, Gray.

1832.—*Pseudomys australis*, Gray, P.Z.S., p. 39.

1910.—*Pseudomys australis*, Thomas, Ann. Mag. Nat. His., vi, p. 605.

Probably includes *Hapalotis murinus*, Gould, to which the following references may be noted :—Gould, P.Z.S., 1845, p. 78 (nec Mamm. Austr., pl. vii) ; *Conilurus murinus*, Ogilby, Cat. Austr. Mamm., 1892, p. 118 ; *Pseudomys murinus* “ (probably = *australis*),” Thomas, Ann. Mag. Nat. His., vi, 1910, p. 606.

Type locality : Liverpool Plains, New South Wales.

Pseudomys auritus, Thomas.

1910.—*Pseudomys auritus*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

This was included by Gould in his *murinus*, and is the subject of plate vii, Mamm. Austr., iii, 1863.

Type locality : Lake Albert, South Australia.

Pseudomys higginsii, Troues.

1882.—*Mus leucopus*, Higgins & Petterd, Pr. Roy. Soc. Tas., p. 174, with plate, fig. 4, 4a.

1892.—*Mus leucopus*, Ogilby, Cat. Austr. Mamm., p. 111.

1904.—*Mus higginsii*, Trouessart, Cat. Mamm., Suppl.

1906.—*Mus higginsii*, Thomas, P.Z.S., p. 766.

1910.—*Pseudomys higginsii*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Habitat : Northern Tasmania.

Pseudomys shortridgei, Thomas.

1906.—*Mus shortridgei*, Thomas, P.Z.S., p. 765.

1910.—*Pseudomys shortridgei*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Habitat : Bernier Island, Western Australia.

Pseudomys lineolatus, Gould.

1845.—*Mus lineolatus*, Gould, P.Z.S., p. 77.

1863.—*Mus lineolatus*, Gould, Mamm. Austr., iii, pl. xviii.

1892.—*Mus lineolatus*, Ogilby, Cat. Austr. Mamm., p. 105.

1910.—*Pseudomys lineolatus*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Habitat : Darling Downs.

Subgenus THETOMYS, Thomas.

Pseudomys nanus, Gould. "Little Rat."1857.—*Mus nanus*, Gould, P.Z.S., p. 243.1863.—*Mus nanus*, Gould, Mamm. Austr., iii, pl. xx.1892.—*Mus nanus*, Ogilby, Cat. Austr. Mamm., p. 108.1898.—*Mus nanus*, Waite, Pr. Roy. Soc. Vic., x, 2, p. 127.1910.—*Pseudomys nanus*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Habitat : Western Australia.

Pseudomys ferculinus, Thomas.1902.—*Mus ferculinus*, Thomas, Ann. Mag. Nat. His., x, p. 491.1910.—*Pseudomys ferculinus*, Thomas, Ann. Mag. Nat. His., vi, p. 606.Habitat : Barrow Is., N. W. Australia. An insular form of *nanus*.**Pseudomys gouldi**, Waterh. "Gould's Rat."1839.—*Mus gouldii*, Waterh., Voy. Beagle, ii, pl. 34, fig. 18a & 18b.1863.—*Mus gouldii*, Gould, Mamm. Austr., iii, pl. xix.1892.—*Mus gouldii*, Ogilby, Cat. Austr. Mamm., p. 107.1896.—*Mus gouldii*?, Waite, Horn Exped. ii, p. 398.1910.—*Pseudomys gouldii*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Habitat : Southern, Eastern, and Central Australia.

Pseudomys gracilicaudatus, Gould.1845.—*Mus gracilicaudatus*, Gould, P.Z.S., p. 77.1857.—*Mus gracilicaudatus*, Gould, P.Z.S., p. 242.1910.—*Pseudomys gracilicauda*, Thomas, Ann. Mag. Nat. His., vi, p. 606.

Type locality : Oakey Creek, Darling Downs.

Pseudomys præconis, Thomas.1910.—*Pseudomys præconis*, Thomas, Ann. Mag. Nat. His., vi, p. 608.

Habitat : Shark's Bay, Western Australia.

Subgenus LEGGADINA.

Pseudomys forresti, Thomas.1906.—*Mus forresti*, Thomas, P.Z.S., p. 536, pl. xxxvii.1910.—*Pseudomys forresti*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

Habitat : Northern Territory.

Pseudomys fieldi, Waite.1896.—*Mus fieldi*, Waite, Horn. Exped. (2) Zool., p. 403, pl. xxvi, fig 4.1906.—*Mus fieldi*, Thomas, P.Z.S., p. 539.

Habitat : Alice Springs, Central Australia.

Pseudomys delicatulus, Gould.

- 1842.—*Mus delicatulus*, Gould, P.Z.S., p. 13.
 1863.—*Mus delicatulus*, Gould, Mamm. Austr., iii, pl. xxiii.
 1892.—*Mus delicatulus*, Ogilby, Cat. Austr. Mamm., p. 109.
 1910.—*Pseudomys delicatulus*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

Habitat : Port Essington.

Pseudomys hermannsburgensis, Waite.

- 1896.—*Mus hermannsburgensis*, Waite, Horn Exped., ii, p. 405, pl. xxvi, fig. 5, a-f.
 1906.—*Mus hermannsburgensis*, Thomas, P.Z.S., p. 539 (habits).
 1910.—*Pseudomys hermannsburgensis*, Thomas, Ann. Mag. Nat. His., vi, p. 607.
 1914.—*Mus hermannsburgensis*, Waite, Tr. Roy. Soc. S. Aus., xxxviii, p. 418.
 1915.—*Mus hermannsburgensis*, Waite, Tr. Roy. Soc. S. Aus., xxxix, p. 736.

Habitat : Central Australia.

Pseudomys patrius, Thos. and Dollm.

- 1908.—*Mus patrius*, Thos. & Dollm., P.Z.S., p. 791.
 1910.—*Pseudomys patrius*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

Type locality : Inkerman, Burdekin River, N.Q.

Subgenus GYOMYS.

Pseudomys novæ-hollandiæ, Waterh. "Common Field Mouse."

- 1842.—*Mus novæ-hollandiæ*, Waterh., P.Z.S., p. 146.
 1863.—*Mus novæ-hollandiæ*, Gould, Mamm. Austr., iii, pl. xxii.
 1892.—*Mus novæ-hollandiæ*, Ogilby, Cat. Austr. Mamm., p. 109.
 1910.—*Pseudomys novæ-hollandiæ*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

Type locality : Yarrundi, Upper Hunter, N.S.W.

Pseudomys albocinereus, Gould.

- 1845.—*Mus albocinereus*, Gould, P.Z.S., p. 78.
 1863.—*Mus albocinereus*, Gould, Mamm. Austr., iii, pl. xxi.
 1892.—*Mus albocinereus*, Ogilby, Cat. Austr. Mamm., p. 108.
 1906.—*Mus albocinereus*, Thomas, P.Z.S., p. 766.
 1910.—*Pseudomys albocinereus*, Thomas, Ann. Mag. Nat. His., vi, p. 607.

Habitat : West Australia.

Subspecies : *Ps. albocinereus squalorum*, Thomas, P.Z.S., 1906, p. 776.

Type locality : Bernier Is., Shark's Bay, W.A.

Pseudomys glaucus, Thomas.

- 1910.—*Pseudomys glaucus*, Thomas, Ann. Mag. Nat. His., vi, p. 609.

Habitat : South Queensland. "A large eastern representative of *Ps. albocinereus*."

References to other species previously attributed to *Mus* may be given here :—

1841.—*Mus adelaidensis*, Gray, App. Grey's Trav. Aus., 1841, p. 410 = *Mus musculus*, Gray, List Mamm. B.M., 1843, p. 111.

*1881.—*Mus albertisii*, Pet. & Dor., Ann. Mus. Civ., xvi, p. 702 ; habitat, Sorong, Papua.

*1881.—*Mus beccarii*, Pet. & Dor., Ann. Mus. Civ., xvi, p. 700 ; habitat, Sorong, Papua. This name is antedated by *Mus beccarii*, Jentink, Notes Leyd. Mus., ii, note iii, p. 11, 1879.

1887.—*Mus burtoni*, Ramsay, P.L.S. N.S.W., 2, p. 553, plate xvii. 1892.—Ogilby, Cat. Austr. Mamm., p. 107 ; habitat, Derby, North-Western Australia. Oldfield Thomas states that this species "does not appear to be determinable from the description."

1884.—*Mus castaneus*, Higgins & Petterd, Roy. Soc. Tas., 1883, p. 183.

1884.—*Mus pachyurus*, Higgins & Petterd, Roy. Soc. Tas., 1883, p. 182.

The position of these two species is uncertain, but Oldfield Thomas, until further material is forthcoming, is inclined to associate them with his *velutinus* or with *fuscipes*, Waterh.

*1911.—*Mus doboënsis*, Beaufort, Abh. Senckenberg Ges., p. 112 ; habitat, Dobo Is., Aru Group.

1882.—*Mus griseoceruleus*, Hig. & Pet., Roy. Soc. Tas., p. 173. Oldfield Thomas considers this a synonym of *E. rattus*.

*1880.—*Mus huegeli*, Thomas, P.Z.S., p. 12 ; habitat, Fiji Islands.

1871.—*Mus novæ-zelandiæ*, Buller, Tr. N. Z. Inst., iii, p. 1, pl. 4 ; Hutton, loc. cit. xi, 1878, p. 344. = *E. rattus*.

1867.—*Mus personatus*, Krefft, P.Z.S., 1867 ; Thomas, Ann. Mag. Nat. His., xvii, 1906, p. 84, "probably belongs to *Mus*."

1904.—*Mus petterdi*, Troues., Cat. Mamm. Suppl., p. 373, new name for *Mus tetragonus*, Higgins and Petterd, Pr. Roy. Soc. Tas., 1883, p. 195 ; habitat, Tasmania.

In 1851 a rodent with a four-sided tail was described, but not named, in Pr. Roy. Soc. Van Diemen's Land, i, p. 176.

1882.—*Mus simsoni*, Hig. & Pet., Pr. Roy. Soc. Tas., 1881, p. 175 ; habitat, Tasmania. Oldfield Thomas marks this as equal to *Mus musculus*.

1884.—*Mus tumarensis*, Hig. & Pet., Pr. Roy. Soc. Tas., 1883, p. 185. This species was "withdrawn" by the describers as "a variety of the common introduced European form."

Mus tasmaniensis, Krefft (Fauna of Tasmania, p. 3, 1868), was never described.

In Mitchell's "Expeditions to Australia" (1838), vol. i, p. xvii, the names are given of *Mus platyrus* and *Mus hoveellii* of Mitchell, said to have been "deposited in the Australian Museum at Sydney." I am indebted to Mr. Allan R. McCulloch for the information that in the Australian Museum "there is no entry of such species, or any specimens which could be identified as representing them," in Secretary Palmer's register, compiled about 1877. The names are merely *nomina nuda*.

The writer desires to acknowledge obligations to Oldfield Thomas, of the British Museum, for his courtesy in giving in correspondence valuable information on several of the above species.

The following three genera, not assignable to the restricted *Epimys*, were separated from "*Mus*" by Oldfield Thomas in 1910.

*Genus CYROMYS, Thomas.

***Cyromys imperator**, Thomas.

1888.—*Mus imperator*, Thomas, Ann. Mag. Nat. His., i, p. 157; P.Z.S., p. 479, pl. xxii, figs 2 & 3.

1910.—*Cyromys imperator*, Thomas, Ann. Mag. Nat. His., vi, p. 507.

Habitat: Solomon Islands.

***Cyromys rex**, Thomas.

1888.—*Mus rex*, Thomas, Ann. Mag. Nat. His., i, p. 157; P.Z.S., p. 480, pl. xxii, figs. 4 & 5.

1910.—*Cyromys rex*, Thomas, Ann. Mag. Nat. His., vi, p. 507.

Habitat: Solomon Islands.

*Genus STENOMYS, Thomas.

***Stenomys verecundus**, Thomas.

1904.—*Mus verecundus*, Thomas, Nov. Zool., xi, p. 598.

1910.—*Stenomys verecundus*, Thomas, Ann. Mag. Nat. His., vi, p. 507.

Habitat: Aroa River, Papua.

***Stenomys niobe**, Thomas.

1906.—*Mus niobe*, Thomas, Ann. Mag. Nat. His., xvii, p. 327.

1910.—*Stenomys niobe*, Thomas, Ann. Mag. Nat. His., vi, p. 507.

Habitat: Papua.

***Stenomys klossi**, Thomas.

1913.—*Stenomys klossi*, Thomas, Ann. Mag. Nat. His., xii, p. 207.

1914.—*Stenomys klossi*, Thomas, Tr. Z.S., xx, pl. 9, p. 320.

Habitat: Charles Louis Mts., Dutch New Guinea.

*Genus BUNOMYS, Thomas.

***Bunomys caelestis**, Thomas.

1896.—*Mus caelestis*, Thomas, Ann. Mag. Nat. His., xviii., p. 248.

1913.—*Bunomys caelestis*, Thomas, Ann. Mag. Nat. His., vi, p. 507.

Habitat: Celebes. "This genus is no doubt the Celebean representative of *Stenomys*."

Genus LEPORILLUS, Thomas.

1906.—*Leporillus*, Thomas, Ann. Mag. Nat. His., xvii, p. 83; 1910, loc. cit., vi, p. 606.

"Molars as in *Nolomys*, without postero-internal cusps. Skull very much as in *Conilurus*. Hind feet normal, with the usual six pads."

Leporillus apicalis, Gould. "White-tipped Jerboa-rat."

1851.—*Hapalotis apicalis*, Gould, P.Z.S., 1851, p. 126.

1863.—*Hapalotis apicalis*, Gould, Mamm. Austr., iii, pl. 2.

1892.—*Conilurus apicalis*, Ogilby, Cat. Austr. Mamm., p. 116.

1896.—*Hapalotis apicalis*, Spencer, Horn Exped., ii, p. 11.

1898.—*Conilurus apicalis*, Waite, Pr. Roy. Soc. Vic., x, p. 115, pl. 5, figs. of skull, molars, and foot.

1906.—*Leporillus apicalis*, Thomas, Ann. Mag. Nat. His., xvii, p. 83.

Habitat : Central Australia.

Genus NOTOMYS, Lesson.

1842.—*Notomys*, Lesson, N. Tabl. R.A. Mamm., p. 129. *Podanomalus*, Waite, Pr. Roy. Soc. Vic., x, 1898, p. 117, is a synonym.

Notomys mitchelli, Ogilby. "Mitchell's Jerboa-rat."

1838.—*Dipus mitchelli*, W. Ogilby, Tr. Linn. Soc., xviii, p. 129.

1892.—*Conilurus mitchelli*, J. D. Ogilby, Cat. Austr. Mamm., p. 119.

1898.—*Hapalotis mitchelli*, Waite, Pr. Roy. Soc. Vic., x, 2, p. 121.

1906.—*Notomys mitchelli*, Thomas, Ann. Mag. Nat. His., xvii, p. 83 ; P.Z.S., p. 539.

Habitat : Central districts.

As to the habits of the Jerboa-like species, Spencer and Gillen suggest that "probably the real advantage of the jumping method of progression amongst the smaller animals lies in the difficulty that birds experience in pouncing down upon an animal which is proceeding by leaps and bounds. It has certainly nothing to do directly with the sandy and arid nature of the country."¹¹

Notomys longicaudatus, Gould.

1844.—*Hapalotis longicaudatus*, Gould, P.Z.S., p. 104.

1863.—*Hapalotis longicaudatus*, Gould, Mamm. Austr., iii, pl. viii.

1892.—*Conilurus longicaudatus*, Ogilby, Cat. Austr. Mamm., p. 119.

1896.—"*Hapalotis mitchelli*," Spencer, Horn Exped., ii, p. 10.

1898.—*Podanomalus longicaudatus*, Waite, Pr. Roy. Soc. Vic., p. 117.

1906.—*Notomys longicaudatus*, Thomas, Ann. Mag. Nat. His., xvii, p. 83.

Habitat : Central Australia.

Notomys gouldii (Gray, 1841), Gould, 1863.

This species was first noted by Gray in the Appendix to Grey's "Travels in Australia," pp. 404 & 413, but it was not described. It was then figured by Gould in Mamm. Austr., iii, pl. 9, as *Hapalotis mitchelli*, but the correct designation of *H. gouldii* was pointed out by Gould in his introduction. Apparently *Hapalotis richardsoni*, Gray, is a synonym. In our "Zool. Voy. Erebus & Terror," vol. i, dated 1845-1875, the reference on p. 12d notes a previous publication of the same work which suggests priority to *richardsoni*, but Oldfield Thomas has pointed out (Brit. Mus. Cat. Marsupialia, p. 227, footnote) that the official date is 1875.

1841.—*Hapalotis gouldii*, Gray, Appen. Grey's Trav. Aus., pp. 404 & 413, *nomen nudum*.

1863.—*Hapalotis gouldii*, Gould, Mamm. Austr., i, p. xxxv ; iii, pl. ix.

1906.—*Notomys gouldii*, Thomas, P.Z.S., p. 767.

Habitat : Western Australia.

¹¹ Spencer and Gillen, "Across Australia," p. 103 (1912).

Genus ASCOPHARYNX, Waite.

Oldfield Thomas considers this genus as not distinct from *Notomys*, as its type, *H. cervinus*, Gould, "agrees both in dental and pedal structure with *mitchelli* and *longicaudatus*." Waite founded the genus on the possession of a gular pouch, which, he suggests, "is used, as in the *Geomyidæ*, for storing food." Thomas notes (P.Z.S., 1906, p. 539) that specimens of *Notomys mitchelli* "have an indication of a glandular organ on the throat, . . ."

Ascopharynx cervinus, Gould. "Fawn-coloured Jerboa-rat."

1851.—*Hapalotis cervinus*, Gould, P.Z.S., p. 127.

1863.—*Hapalotis cervinus*, Gould, Mamm. Austr., iii, pl. x.

1892.—*Conilurus cervinus*, Ogilby, Cat. Austr. Mamm., p. 120.

1896.—*Hapalotis cervinus*, Spencer, Horn Exped., ii, p. 11.

1898.—*Thylacomys cervinus*, Waite, Pr. Roy. Soc. Vic., x, 2, p. 122.

1900.—*Ascopharynx* (*Thylacomys* pre-oc.) *cervinus*, Waite, Ann. Mag. Nat. His., v, p. 222.

1906.—*Notomys cervinus*, Thomas, Ann. Mag. Nat. His., xvii, p. 82.

1912.—*Notomys cervinus*, Spencer & Gillen, "Across Australia," i, p. 166.

1915.—*Ascopharynx cervinus*, Waite, Tr. Roy. Soc. South Aus., xxxix, p. 735.

Habitat : Central Australia.

Genus CONILURIS Ogilby.

Conilurus albipes, Licht. "Nest-building Jerboa-rat."

1829.—*Hapalotis albipes*, Licht., Darst. der Saugth., tab. 29.

1838.—*Conilurus constructor*, Ogilby, Tr. Linn. Soc., xviii, p. 126.

1839.—*Hapalotis albipes*, Gray, Ann. Mag. Nat. His., ii, p. 308.

1849.—*Mus conditor*, Gould in Sturt's Ex. Cen. Aus., i, p. 120, plate ;
ii, Appen., p. 7.

1863.—*Hapalotis conditor*, Gould, Mamm. Austr., iii, pl. vi.

1863.—*Hapalotis albipes*, Gould, Mamm. Austr., iii, pl. i.

1892.—*Hapalotis albipes*, Ogilby, Cat. Austr. Mamm., p. 114.

1906.—*Conilurus albipes*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.

Habitat (*J. D. Ogilby*) : South-Eastern Australia ; southern portion of South Australia.

A curious *lapsus calami* occurs in T. S. Palmer's useful list of the Generic and Family Names of Rodents (Proc. Biol. Soc. Wash., xi, p. 259, 1897), where this species is noted as *Conilurus destructor*.

Conilurus penicillatus, Gould. "Black-tailed Jerboa-rat."

1842.—*Mus penicillatus*, Gould, P.Z.S., p. 12.

1843.—*Hapalotis melanura*, Gray, Mamm. Brit. Mus., p. 115.

1863.—*Hapalotis penicillata*, Gould, Austr. Mamm., iii, pl. v.

1892.—*Conilurus penicillatus*, Ogilby, Cat. Austr. Mamm., p. 117.

1906.—*Conilurus penicillatus*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.

Habitat : Northern Queensland. "Long-haired Jerboa-rat."

Genus MESEMBRIOMYS, Palmer, 1906.

This genus supersedes *Ammomys*, Thomas, 1906 (pre-occupied), Pr. Biol. Soc., Wash., xix, p. 97.

Mesembriomys hirsutus, Gould.

- 1842.—*Mus hirsutus*, Gould, P.Z.S., p. 12.
 1851.—*Mus hirsutus*, Gould, P.Z.S., p. 127.
 1863.—*Hapalotis hirsutus*, Gould, Mamm. Austr., iii, pl. iv.
 1892.—*Conilurus hirsutus*, Ogilby, Cat. Austr. Mamm., p. 117.
 1897.—*Conilurus hirsutus*, Collett, P.Z.S., p. 322.
 1906.—*Ammomys hirsutus*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.
 1909.—*Mesembriomys hirsutus*, Thomas, Ann. Mag. Nat. His., iii, p. 372.

Habitat : Northern Queensland.

Hapalotis hemileucura, described by Gray (P.Z.S., xxv, p. 243, 1857) and illustrated by Gould (Austr. Mamm. iii, pl. iii), has not been incorporated by Oldfield Thomas in his revised list, and is probably regarded as a synonym. Only a single specimen was procured. Mr. A. R. McCulloch (Australian Museum) informs me that it is listed as a valid species in Trouessart's Catalogus Mammalium, i, 1897, p. 504. Unfortunately, this work is not obtainable in Brisbane.

Mesembriomys macrurus, Peters.

- 1876.—*Hapalotis macrurus*, Peters, Mon. Ak. Berl., p. 355, plate p. 366.
 1892.—*Conilurus macrurus*, Ogilby, Cat. Austr. Mamm., p. 115.
 1904.—*Conilurus macrurus*, Thomas, Nov. Zool., xi, p. 222.
 1906.—*Ammomys macrurus*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.
 1909.—*Mesembriomys macrurus*, Thomas, Ann. Mag. Nat. His., iii, p. 372.

R. Collett (P.Z.S., 1897, p. 322) says there is much reason to believe that *Hapalotis boweri*, Ramsay (P.L.S. N.S.W. (2), i, p. 1153, 1886), is identical with *macrurus*.

Habitat : North Australia.

Genus ZYZOMYS, Thomas.

Separated from *Mesembriomys*, 1909.

Zyzomys argurus, Thomas.

- 1889.—*Mus argurus*, Thomas, Ann. Mag. Nat. His., iii, p. 433.
 1906.—*Ammomys argurus*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.
 1909.—*Mesembriomys argurus*, Thomas, Ann. Mag. Nat. His., iii, p. 151.
 1909.—*Zyzomys argurus*, Thomas, Ann. Mag. Nat. His., iii, p. 372.

Habitat : South Australia.

Zyzomys argurus indutus, Thomas.

- 1909.—*Zyzomys argurus indutus*, Thomas, Ann. Mag. Nat. His., iii, p. 151.

Type locality : Parry's Creek, Kimberley, N. W. Australia.

Genus LAOMYS, Thomas.

"The species of this genus are remarkable-looking animals, quite unlike ordinary Muridæ, and more suggesting members of the South-American Octodontinæ."

Laomys woodwardi, Thomas.

1909.—*Laomys woodwardi*, Thomas, Ann. Mag. Nat. His., iii, p. 373.

Habitat : Kimberley, N. W. Australia.

Laomys pedunculatus, Waite.

1896.—*Conilurus pedunculatus*, Waite, Horn Exped., ii, p. 395, fig. 1, *a-f*.

1898.—*Conilurus pedunculatus*, Waite, Pr. Roy. Soc. Vic., x, 2, p. 117.

1906.—*Ammomys pedunculatus*, Thomas, Ann. Mag. Nat. His., xvii, p. 84.

1909.—*Laomys pedunculatus*, Thomas, Ann. Mag. Nat. His., iii, p. 373.

1912.—*Ammomys pedunculatus*, Spencer & Gillen, "Across Australia," i, p. 166.

In his original description, Waite notes a var. *brachyotis*.

Type locality : Alice Springs, Central Australia.

Genus MASTACOMYS, Thomas.

1882.—*Mastacomys*, Thomas, Ann. Mag. Nat. His., ix, p. 413.

"Like *Mus*, but with the molars enormously broadened and of a somewhat different pattern, and with fewer mammæ."

Mastacomys fuscus, Thomas.

1882.—*Mastacomys fuscus*, Thomas, Ann. Mag. Nat. His., ix, p. 413.

1885.—*Mastacomys fuscus*, Lydekker, B.M. Cat. Fos. Mamm., i, p. 227 (fossil remains from Wellington Valley Caves, N.S.W.).

1892.—*Mastacomys fuscus*, Ogilby, Cat. Austr. Mamm., p. 120.

Habitat : Tasmania.

Mastacomys sp.

E. R. Waite, who has done much useful work on Australian Muridæ, refers (Horn Exped., Zool., ii, p. 406) to specimens of *Mastacomys* from Alice Springs, Central Australia, which have the characteristically broad molars of this genus, but which were too immature for specific determination.

Genus UROMYS, Peters.

1867.—*Uromys*, Peters, Mon. Ak. Berlin, p. 343.

This large genus was founded by Peters on the *Mus macropus* of Gray ; the great majority of the species are Papuan.

Uromys macropus, Gray.

1866.—*Mus macropus*, Gray, P.Z.S., 1866, p. 221 ; loc. cit. 1867, p. 597.

1867.—*Hapalotis caudimaculata*, Kreffit, P.Z.S., p. 316, fig. 1-7 (skull).

1867.—*Uromys macropus*, Peters, Mon. Ak. Berl., p. 344, with plate.

1887.—*Uromys macropus*, Collett, Zool. Jahr., p. 840.

1892.—*Uromys macropus*, Ogilby, Cat. Austr. Mamm., p. 121.

Habitat : North-Eastern Australia.

Uromys cervinipes, Gould.

1863.—*Mus cervinipes*, Gould, Mamm. Austr., iii, pl. xiv (ref. to P.Z.S., 1852 ; not found).

1888.—*Uromys cervinipes*, Thomas, P.Z.S., pp. 237 & 484.

1889.—*Uromys cervinipes*, Thomas, P.Z.S., p. 248.

1892.—*Uromys cervinipes*, Ogilby, Cat. Austr. Mamm., p. 121.

Habitat : Eastern Australia.

Uromys melicus, Thomas.

1913.—*Uromys melicus*, Thomas, Ann. Mag. Nat. His., xii, p. 215.

“ A very similar *Uromys* occurs in some of the islets off the Cape York coast, but our material is not sufficient to say if it is or is not specifically identical with the Melville Island species.”—*Thomas*.

Habitat : Melville Island, Northern Territory.

***Uromys rufescens**, Alston.

1877.—*Uromys rufescens*, Alston, P.Z.S. (1), p. 124 ; loc. cit., p. 743.

1877.—*Mus musavora*, Ramsay, P.L.S. N.S.W., ii (July), p. 15.

1881.—*Uromys musovoros*, Pet. & Dor., Mus. Civ., Gen., xvi, p. 705.

This is apparently included by Oldfield Thomas (P.Z.S., 1888, p. 484) in the synonymy of *U. cervinipes*.

Habitat : Duke of York Island.

***Uromys bruijnii**, P. & D.

1876.—*Uromys bruijnii*, Pet. & Dor., Mus. Civ., Genov., viii, p. 336 ; loc. cit., xvi, 1881, p. 704.

1897.—*Uromys bruijnii*, Thomas, Mus. Civ., Genov., xviii, p. 617.

This species is closely allied to *U. cervinipes*.

Habitat : Papua. Type locality : Salawatti.

Uromys banfieldi, De Vis.

1907.—*Uromys banfieldi*, De Vis, Ann. Qld. Mus., 7, p. 8.

Oldfield Thomas (Ann. Mag. Nat. His., xii, 1913, p. 215) refers to this species as “ doubtfully distinct ” from *U. cervinipes*.

Habitat : Dunk Island.

***Uromys aruensis**, Gray.1873.—*Uromys aruensis*, Gray, Ann. Mag. Nat. His., xii, p. 418.

Habitat : Aru Islands.

***Uromys validus**, Pet. & Dor.1881.—*Uromys validus*, Pet. & Dor., Mus. Civ., Gen., xvi, p. 703.1897.—*Uromys validus*, Thomas, Mus. Civ., Gen., xviii, p. 616.1907.—*Uromys validus*, Thomas, Ann. Mag. Nat. His., xx, p. 73.1913.—*Uromys validus*, Thomas, Ann. Mag. Nat. His., xii, p. 212.

Type locality : Katau, Papua.

***Uromys moncktoni**, Thomas.1904.—*Uromys moncktoni*, Thomas, Ann. Mag. Nat. His., xiv, p. 399.“ Allied to *U. levipes*, Thos., but with shorter feet and more hairy tail.”

Habitat : Papua.

***Uromys stalkerii**, Thomas.1904.—*Uromys stalkerii*, Thomas, Ann. Mag. Nat. His., xiv, p. 202.

Habitat : Gira River, Papua.

***Uromys stalkerii calidior**, Thomas.1914.—*Uromys s. calidior*, Thomas, Tr. Z.S., xx, 9, p. 321.

Habitat : Dutch New Guinea.

***Uromys levipes**, Thomas.1897.—*Uromys levipes*, Thomas, Mus. Civ., Gen., xviii, p. 617.

Habitat : Papua ; “ typical locality, Haveri.”

***Uromys platyops**, Thomas.1906.—*Uromys platyops*, Thomas, Ann. Mag. Nat. His., xvii, p. 327.1914.—*Uromys platyops*, Thomas, Tr. Z.S., xx, 9, p. 322.

Habitat : Aroa River, Papua.

***Uromys gracilis**, Thomas.1906.—*Uromys gracilis*, Thomas, Ann. Mag. Nat. His., xvii, p. 328.

Habitat : Owgarra, Angabunga R., Papua.

***Uromys anak**, Thomas.1907.—*Uromys anak*, Thomas, Ann. Mag. Nat. His., xx, p. 72.

Habitat : Brown River, Papua.

***Uromys naso**, Thomas.1911.—*Uromys naso*, Thomas, Ann. Mag. Nat. His., vii, p. 386.1914.—*Uromys naso*, Thomas, Tr. Z.S., xx, 9, p. 321.

“ The distinction of this *Uromys* from *U. lorentzii* is perhaps rather doubtful. The two skulls of it in the collection are, however, markedly larger than those of any of the considerable series of that animal.”

Habitat : Papua.

***Uromys obiensis**, Thomas.1911.—*Uromys obiensis*, Thomas, Ann. Mag. Nat. His., vii, p. 208.

Habitat : Obi Island.

***Uromys lorentzi**, Jent.1908.—*Pogonomys lorentzi*, Jent., Res. Ex., Néerl. Nouv.-Guin., i, 9, p. 8.1913.—*Uromys lorentzi*, Thomas, Ann. Mag. Nat. His., xii, p. 210.1914.—*Uromys lorentzi*, Thomas, Tr. Z.S., xx, 9, p. 321.

Habitat : Dutch New Guinea.

***Uromys porculus**, Thomas.1904.—*Uromys porculus*, Thomas, Ann. Mag. Nat. His., xiv, p. 400.

Habitat : Guadalcanar, Solomon Is.

***Uromys sapientis**, Thomas.1902.—*Uromys sapientis*, Thomas, Ann. Mag. Nat. His., ix, p. 446.1904.—*Uromys sapientis*, Thomas, Ann. Mag. Nat. His., xiv, p. 400.

Habitat : Ysabel Island, Solomons.

***Uromys leucogaster**, Jent.1908.—*Pogonomys leucogaster*, Jent., Nov. Guin., Rés. Exp. Scien., Néerl., i, 9, p. 9.1914.—*Uromys leucogaster*, Thomas, Tr. Z.S., xx, 9, p. 322.

Habitat : Noord River, Dutch New Guinea.

***Uromys multiplicatus**, Jent., 1907.1907.—*Pogonomys multiplicatus*, Jent., Nova Guinea, 5, p. 367.1913.—*Uromys multiplicatus*, Thomas, Ann. Mag. Nat. His., xii, p. 209.1914.—*Uromys multiplicatus*, Thomas, Tr. Z.S., xx, 9, p. 320.

Habitat : Dutch New Guinea.

***Uromys scaphax**, Thomas.1913.—*Uromys scaphax*, Thomas, Ann. Mag. Nat. His., xii, p. 209.1914.—*Uromys scaphax*, Thomas, Tr. Z.S., xx, 9, p. 321.

Habitat : Dutch New Guinea.

***Uromys barbatus**, Mil.-Edw.1900 1910.—*Mus barbatus*, Mil.-Edw., Bull. Mus. Paris, p. 167.1907.—“*Mus barbatus*,” Thomas, Ann. Mag. Nat. His., xx, p. 73.1913.—*Uromys barbatus*, Thomas, Ann. Mag. Nat. His., xii, p. 212.

Habitat : Papua.

***Uromys arcium**, Thomas.1913.—*Uromys arcium*, Thomas, Ann. Mag. Nat. His., xii, p. 214.

Habitat : Rossel I., d'Entrecasteaux Group.

***Uromys lutillus**, Thomas.

1913.—*Uromys lutillus*, Thomas, Ann. Mag. Nat. His., xii, p. 216.

Habitat : Papua.

Uromys murinus, Thomas.

1913.—*Uromys murinus*, Thomas, Ann. Mag. Nat. His., xii, p. 216.

Habitat : Murray Islands, Torres Strait.

***Uromys nero**, Thomas.

1913.—*Uromys nero*, Thomas, Ann. Mag. Nat. His., xii, p. 208.

Habitat : Dutch New Guinea.

***Uromys mollis**, Thomas.

1913.—*Uromys mollis*, Thomas, Ann. Mag. Nat. His., xii, p. 210.

1914.—*Uromys mollis*, Thomas, Tr. Z.S., xx, 9, p. 322.

Habitat : Dutch New Guinea.

***Uromys ductor**, Thomas.

1913.—*Uromys ductor*, Thomas, Ann. Mag. Nat. His., xii, p. 213.

Habitat : Avera, Aroa River, Papua.

***Uromys prolixus**, Thomas.

1913.—*Uromys prolixus*, Thomas, Ann. Mag. Nat. His., xii, p. 213.

Habitat : Haveri, Papua.

***Uromys muscalis**, Thomas.

1913.—*Uromys muscalis*, Thomas, Ann. Mag. Nat. His., xii, p. 217.

Habitat : Lower Fly River, Papua.

***Uromys rothschildi**, Thomas.

1912.—*Uromys rothschildi*, Thomas, Nov. Zool., xix, p. 91.

Habitat : Rawlinson Mts., Papua.

***Uromys (?) salamonis**, Ramsay.

1882.—*Mus salamonis*, Rams., P. Lin. Soc. N.S.W., vii, p. 43, pl. v.

1887.—*Mus salamonis*, Thomas, P.Z.S., p. 327.

1888.—*Mus salamonis*, Thomas, P.Z.S., p. 481.

1902.—*Mus salamonis*, Thomas, Ann. Mag. Nat. His., ix, p. 446.

Habitat : Solomon Islands.

Uromys papuanus, A. B. Meyer, Ann. Mag. Nat. His., 1876, p. 146, was not described. *Haplotis papuanus*, Ramsay (P.L.S. N.S.W., viii, 1883, p. 18), has been referred to *Uromys*, but Oldfield Thomas says (Ann. Mag. Nat. His., xii, 1913, p. 213) : " I think it best to treat the species as indeterminable," the type having disappeared.

*Genus MALLOMYS, Thomas, 1898.

***Mallomys rothschildi**, Thomas.1898.—*Mallomys rothschildi*, Thomas, Nov. Zool., v, p. 1.1912.—*Mallomys rothschildi*, Thomas, Nov. Zool., xix, p. 92.1914.—*Mallomys rothschildi*, Thomas, Tr. Z.S., xx, 9, p. 319.

Habitat : Papua and Dutch New Guinea.

The species tentatively named "*Dendrosminthus aroaensis*" by De Vis (Annals of the Queensland Museum, No. 7, 1907, p. 10) is a synonym, although the idiosyncrasies of description might not suggest identity. The skin is not available, but the skull of De Vis' type agrees in detail with the characteristics noted by Thomas. It may be considered a doubtful matter as to whether De Vis' tentative naming constitutes an official record. His specimen came from the head of the Aroa River, whilst the type location for *M. rothschildi* is further inland. The collector of the Queensland Museum specimen states that this rat is arboreal.

***Mallomys hercules**, Thomas.1912.—*Mallomys hercules*, Thomas, Nov. Zool., xix, p. 92.

Habitat : Rawlinson Mts., Papua.

This species is larger than *M. rothschildi*, and is the giant of the subfamily Murinæ.

*Genus HYOMYS, Thomas, 1903.

***Hyomys meeki**, Thomas.1903.—*Hyomys meeki*, Thomas, P.Z.S., ii, p. 198, pl. xxiii, figs. 2, *a-c*.

Habitat : Aroa River, Papua.

*Genus ANISOMYS, Thomas, 1903.

***Anisomys imitator**, Thomas.1903.—*Anisomys imitator*, Thomas, P.Z.S., ii, p. 200, pl. xxiii, figs. 1, *a-e*.

Habitat : Aroa River, Papua.

*Genus POGONOMYS, Mil.-Edw., 1877.

***Pogonomys macrourus**, Mil.-Edw.1877.—*Pogonomys macrourus*, Mil.-Edw., Comptes Rendu, Paris, vol. 85, p. 1081.

Habitat : Papua.

***Pogonomys mollipilosus**, Pet. & Dor.1881.—*Mus mollipilosus*, Pet. & Dor., Ann. Mus. Civ., Gen., xvi, p. 698.1897.—*Pogonomys mollipilosus*, Thomas, Ann. Mus. Civ., Gen., xviii, p. 613.

Habitat : Katau, Papua.

***Pogonomys dryas**, Thomas.1904.—*Pogonomys dryas*, Thomas, Nov. Zool., xi, p. 600.

Habitat : Papua.

***Pogonomys loriæ**, Thomas.

1897.—*Pogonomys loriæ*, Thomas, Ann. Mus. Civ., Gen., xviii, p. 613.

Habitat : Haveri, Papua.

***Pogonomys lepidus**, Thomas.

1897.—*Pogonomys lepidus*, Thomas, Ann. Mus. Civ., Gen., xviii, p. 614.

Habitat : Haveri, Papua.

***Pogonomys vates**, Thomas.

1908.—*Pogonomys vates*, Thomas, Ann. Mag. Nat. His., ii, p. 495.

Habitat : Papua.

***Pogonomys sexplicatus**, Jent.

1907.—*Pogonomys sexplicatus*, Jent., Nova Guinea, 5, p. 366.

Habitat : Sentaki Lake, Dutch New Guinea.

***Pogonomys forbesi**, Thomas.

1888.—*Chiruromys forbesi*, Thomas, P.Z.S., p. 239, figs. 1 & 2.

1897.—*Pogonomys forbesi*, Thomas, Mus. Civ., Gen., xviii, p. 613.

Habitat : Haveri, Papua.

The genus *Chiruromys* was established by Thomas in 1888 (loc. cit.), but was afterwards merged in *Pogonomys* ; the name, however, may be retained for a specialised section including *P. forbesi*, *pulcher*, and *lamia*.

***Pogonomys pulcher**, Thomas.

1895.—*Chiruromys pulcher*, Thomas, Nov. Zool., ii, p. 164.

1897.—*Pogonomys pulcher*, Thomas, Mus. Civ., Gen., xviii, p. 613.

Habitat : Fergusson Is., D'Entrecasteaux Group.

***Pogonomys lamia**, Thomas.

1897.—*Pogonomys lamia*, Thomas, Mus. Civ., Gen., xviii, p. 613.

Habitat : Papua ; type locality, Ighibirei.

*Genus LORENTZIMYS, Jent., 1911.

***Lorentzimys nouhuysii**, Jent.

1911.—*Lorentzimys nouhuysii*, Jent., Nova Guinea, 9, p. 174.

Habitat : Noord River, Dutch New Guinea.

**Echiothrix (Craurothrix) leucurus*, Gray, once attributed mistakenly to Australia, is a Celebes species.

SNAKES AND LIZARDS FROM QUEENSLAND AND THE NORTHERN TERRITORY.

BY HEBER A. LONGMAN.

SNAKES.

ACROCHORDUS JAVANICUS, Hornstedt.

(Plate VI.)

THROUGH the kindness of Mr. Esmond Parkinson, of the Queensland Railways Department, the Queensland Museum received in June last a magnificent specimen of *Acrochordus javanicus* (♀) nearly 7 feet in length. This snake was secured alive from the Leichhardt River, which flows into the Gulf of Carpentaria. In the collection there previously existed a head, attributed to the same genus, said to have come from the Gilbert River in the same district, but as there was some doubt as to the locality no record was published. Now it is evident that this head represents an immature example of the same species.

This snake is occasionally found in the Malay Peninsula, Siam, Java, and New Guinea, and its discovery in North Queensland makes an interesting addition to its range. With its ally *Chersydrus granulatus*, it is placed in the subfamily Acrochordinae of the Aglypha series. Barbour suggests that *Chersydrus* "is barely separable generically" from *Acrochordus*, and that it may on critical analysis be reduced to subgeneric rank.¹ Our specimen agrees well with the descriptions given by Günther² and Boulenger,³ but there are a few points which may be noted. Running from the gular region to the anus are ventral series of narrow elongated spinose scales, about four wide, which are sharply differentiated from the adjoining lepidosis. Duméril and Bibron state⁴: "Le ventre est plat, quoique présentant une légère saillie correspondant à la série des tubercules, qui se joignent deux à deux par une sorte de suture." The writer has no exotic specimens for purposes of comparison, and it is thus possible that the sharply differentiated median ventral series of scales in our snake may be so distinct from the more northern forms as to establish varietal or even specific rank. This Leichhardt River snake is light chocolate brown above, with lighter very irregular markings forming an indistinct series of bands. The sides and ventral surface are lighter, and many of the spinose scales (which in structure bring to mind those of certain Agamid lizards) present the appearance of white enamel. There are about 145 scales around the body, 24 rows or so of the median dorsal series being considerably larger, some being over 3 mm. high.

The dimensions are as follow:—Total length 2,100 mm.; head 68 mm.; tail 245; max. diam. 300 mm. Weight 8 lb. 7 oz.

¹ 1912. Barbour, Zoogeog. East Indian Is., Bull. Mus. Comp. Zool., Harv., xliv, No. 1.

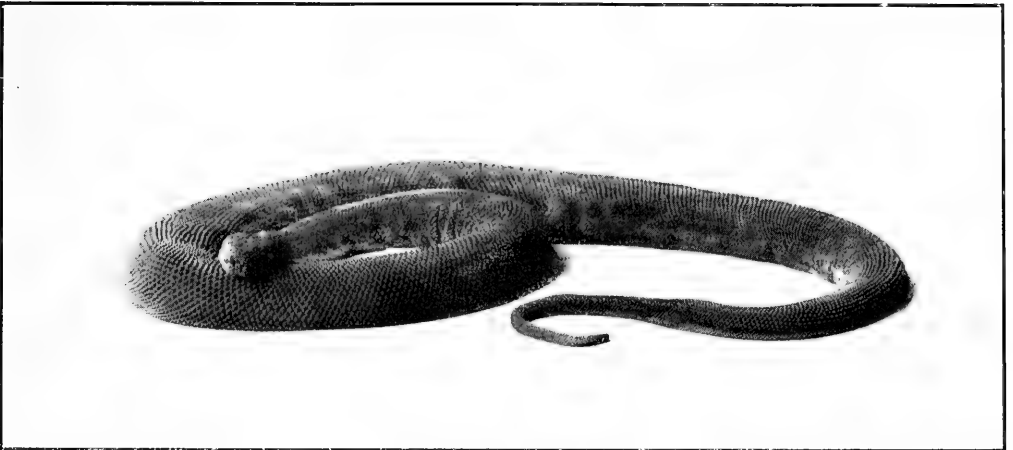
² Günther, Rept. Brit. India, 1864, p. 336.

³ Boulenger, Brit. Mus. Catalogue, i, p. 173.

⁴ Duméril et Bibron, Erp. Gén., vii, p. 33, 1854.

ACROCHORDUS JAVANICUS.

PLATE VI.



ACROCHORDUS JAVANICUS, Hornstedt.

(Photographed shortly after death.)

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Günther mentions (loc. cit.) that this snake grows to a length of 8 feet, and S. S. Flower records that he obtained a specimen from Sapatoom which was 6 feet in length. S. S. Flower⁵ says: "This snake, when alive and fresh caught, is of immense girth and very powerful, twisting round one's arms with a grasp like that of a python. It seems to be purely aquatic (though Cantor records an exception), frequenting canals and ditches. On land as a rule it is very sluggish, but when aroused will strike suddenly with great force, and can inflict an unpleasant bite, as its teeth are apt to break off in the wound." F. F. Laidlaw notes that the Malays call this reptile "the elephant's trunk snake."⁶

On examining our specimen for entozoa, the remarkable length of the tracheal and true lung was noted, it being extended through the whole body cavity. On reference to literature, the writer finds that this specialisation has already been recorded by J. C. Thompson in his useful contribution to the anatomy of the Ophidia.⁷ In the stomach were found remains of elytra of beetles, which Mr. H. Hacker informs me belong to the *Dytiscidae*, a family of water beetles. Earlier observers have noted that this species feeds on fruits—a curious characteristic for an ophidian. Cantor stated that a female in his possession brought forth not less than twenty-seven young ones in the course of about twenty-five minutes; they were very active and bit fiercely.

Reg. No. Q.M. J 15/2384.

In November, 1915, we received a skin (6 feet 3 inches in length) of this species which had been obtained in the Lukin River, near Ebagoolah, a more northern stream which also flows into the Gulf of Carpentaria. For this snake the Museum was indebted to Mr. H. S. Martin.

The close ally, *Chersydrus granulatus*, Schneid., which is occasionally found on the North Queensland coast, is a smaller snake.^{7a} Its scales are far less rough, being tuberculated and not strongly spined, and the nostrils are not placed so anteriorly as those of *Acrochordus javanicus*.

ASPIDIOTES MELANOCEPHALUS, Krefft.

From Maneroo Station, near Longreach, a specimen was forwarded to the Museum which extends our knowledge of the dietary of a hungry snake. This consists of the fore part (about 12 inches) of a black-headed python, *Aspidiotes melanocephalus*, and almost completely engulfed in its enormously extended jaws is the head of a large plain turkey or Australian bustard, *Chloriotis australis*. As the snake is a comparatively small one, being only about 1 inch in diameter, whilst the turkey's head is fully two and a half times that, the bony bulk of the attempted meal will be realised. It seems that one of the men on the station, after shooting a turkey, had cut off its head and thrown it down. Subsequently passing the spot he found the snake lying dead. The specimen was preserved and then donated to the Queensland Museum by Mr. J. Dickson.

⁵ S. S. Flower, P.Z.S., 1899, p. 658.

⁶ F. F. Laidlaw, P.Z.S., 1901 (2), p. 576.

⁷ J. C. Thompson, P.Z.S., 1913, p. 414.

^{7a} Lonnberg and Anderson (Vet.-Ak. Handl., Stockholm, Bd. 52, No. 7, 1915) note an example of this snake from Cairns as its first Australian record. The Queensland Museum has received a number of specimens, and the snake was recorded for Australia twelve years before by E. R. Waite in vol. v, Records of the Australian Museum.

ASPIDIOTES RAMSAYI, Macleay.

A very robust specimen of *Aspidiotes ramsayi*, just over 2 metres in length, has been forwarded from Yeulba in Western Queensland by Mr. J. P. Bennett. Some doubt has been expressed as to the presence of suboculars separating the upper labials from the eye in this species. Macleay's type is apparently lost, and his description has been differently interpreted by Boulenger⁸ and E. R. Waite.⁹ In specimens examined by the last-named, the seventh labial enters the eye, but our snake is of interest because there are very distinct shields separating the labials from the eye on each side. Each new specimen received adds to our knowledge of the variability of the head-shields of these snakes.

RHYNCHELAPS AUSTRALIS, Krefft.

Ten Queensland specimens of this snake were recently examined, and the following variations may be noted. In one the maximum number of body-scales is but 15, and there are but 5 upper labials. Two other examples show this reduction of the upper labials, and Krefft also noted a Clarence River specimen with this variation.¹⁰ In all our specimens the frontal is distinctly shorter than its distance from the end of the snout. The internasals are in one case completely separated by the posterior angle of the rostral.

RHYNCHELAPS LATIZONATUS, De Vis.

This snake, described by De Vis in Annals of the Queensland Museum, No. 6, 1905, p. 49, cannot be separated from the larger forms of *Furina occipitalis*, D. & B.

PSEUDELAPS CHRISTIEANUS, Fry.

In February, 1915, we received from Mr. Gerald F. Hill a species of *Pseudelaps* from Port Darwin which the writer described in manuscript as new, associating with it the name of the donor, to whom the Queensland Museum is indebted for many interesting specimens. Correspondence with Mr. D. B. Fry, then of the Australian Museum, Sydney, showed that he had previously received the same species from the same locality, and this was subsequently described and figured as *Pseudelaps christieanus*.¹¹ Our specimen agrees well with Fry's description, but is somewhat larger, being 290 mm. in length. There are 175 ventrals and 57 pairs of subcaudals (tail uninjured). The writer has also received a specimen of the allied *Pseudelaps diadema* from Port Darwin. Garman recorded this species from Cooktown¹² and Boulenger from "North Australia."

LIZARDS.

CALYPTOTIS FLAVIVENTER, De Vis.

In 1886 De Vis described,¹³ in conjunction with three species of *Salaris*, a new genus and species of skink which appear to have escaped notice except for a nominal record in Lucas and Frost's list.¹⁴ Although the type is lost, there is

⁸ Boulenger, B.M.C. Snakes, i, p. 92.

⁹ Waite, P.L.S. N.S.W., ix, p. 715, 1894.

¹⁰ Krefft, Snakes of Australia, 1869, p. 52.

¹¹ Fry, Roy. Soc. Qld., xxvii, pt. 1, p. 91, 1915.

¹² Bull. Mus. Comp. Zool., Harv., xxxix, p. 12, 1901.

¹³ Proc. Roy. Soc. Qld., ii, 1886, p. 57.

¹⁴ Aus. Assn. Ad. Sci., Rep. 1901, p. 261.

no doubt that De Vis' species was a *Lygosoma* (*Siaphos*) *scutirostrum*, Peters. (Several examples of this skink were recently collected by the writer at Toowoomba, being partly buried in the humus under logs.) The deep yellowish colour of the ventral surface, which is very noticeable in life, generally disappears in specimens preserved in formalin. The species is recorded by Boulenger in the British Museum Catalogue, iii, p. 330.

LYGOSOMA BANCROFTI, sp. nov.

From the Upper Dawson River district we recently received, through Dr. T. L. Bancroft, a skink which is of considerable interest because it illustrates another intermediate stage of limb degeneration in the *Lygosoma verreauxii*, *truncatum*, *frontalis*, *ophioscincus* group.

Body elongate and resembling that of *L. verreauxii*. Anterior limbs didactyle; posterior undivided and very minute, only projecting about a millimetre. Head much as in *L. verreauxii*, but prefrontals larger and frontal subhexagonal with antero-lateral sutures almost as long as postero-lateral sutures. Lower eyelid scaly. Ears hidden. Twenty scales around the middle of the body; dorsals slightly larger. A pair of enlarged preanals. Tail (apparently undamaged) shorter and thinner than body. Silver grey above, many of the scales having a dark spot in the centre; whitish below. There is no trace of the white (rarely orange) nuchal band which is so characteristic of *L. verreauxii*.

Total length 185 mm.; tail 50; fore-limb 3.5; body diam. 7.

Reg. No. Q.M. J 15/2560.

As it was desirable to note the range of variation in *L. verreauxii*, a series of over sixty specimens of that common skink was examined. Considering the dactylic variation which has been noted in this genus by Boulenger and others, it is surprising to find that in every case, except where the limbs were obviously broken, three digits were present. The digits are, however, more prominent in *verreauxii* than in *bancrofti*, and the hind limbs are relatively longer. Although there is considerable variation in the shape of the frontal in this large series, the antero-lateral sutures between it and the prefrontals are relatively distinctly less than in *L. bancrofti*. The didactyle fore and the minute hind limbs, together with the shape of the frontal and the absence of a nuchal collar, easily distinguish this new species from *verreauxii*.

Although the limbs are so degenerate, they are still of considerable use to these skinks. When a living *L. verreauxii* is placed on the ground, the stumps are moved with remarkable speed and vigour in the endeavour to promote locomotion over a comparatively smooth surface. It is perhaps worth recording that in the tiny pelvic girdle of this skink, all three elements (ilium, ischium, and pubis) are present on each side in a specimen examined.

Anomalopus lentiginosus, De Vis,¹⁵ described as with fore-limbs didactyle and with a white nuchal collar, is recorded by Boulenger as a synonym of *L. verreauxii* (Zool. Rec., 1888).

LYGOSOMA TRUNCATUM, Peters.

A specimen which agrees well with Peters' description was found at Moreton Island last April by Mr. R. W. McMillan and donated to the Queensland Museum. This rare lizard is 90 mm. in length and nearly 4 mm. in diameter.

¹⁵ Proc. Lin. Soc. N.S.W. (2), ii, 1888, p. 823.

MOCOA CÆRULEOCAUDA, De Vis.

It may here be conveniently recorded that *Mocoa cæruleocauda*, De Vis,¹⁹ from Sudest Island, Louisiades, is a synonym of *Lygosoma cyanurum* (Lesson).

DIPLODACTYLUS INTERMEDIUS, J. D. Ogilby.

From the Darling Downs we have received specimens which were first referred to *Diplodactylus strophurus*, D. & B., but on further examination these are thought to be more correctly designated as *D. intermedius*, Ogilby.¹⁷ It is remarkable that ~~Boulenger~~ Ogilby, and Werner refer to Duméril and Bibron's *D. strophurus* as being without tubercles in the caudal region, and this negative characteristic appears in diagnostic tables. This is not in keeping either with the illustration (Plate 32, fig. 1) or the original description by the French herpetologists, as the following extract will show:—"Sur le dessus de la queue, on voit successivement, depuis sa racine jusqu'aux deux tiers de sa longueur, deux rangs transversaux de tubercules, et deux rangs de très petits grains squammeux; mais à partir de cet endroit les rangs de grains augmentent de plus en plus jusqu'à la pointe caudale."¹⁸ Ogilby's *D. intermedius* is thus more closely allied to *D. strophurus* than has been noted, but it seems distinguishable by its yellow tubercles and the black granules which dot both lower and upper surfaces. From *D. spinigerus* it is marked by its longer snout and more regular series of dorsal tubercles. Duméril and Bibron's species came from Shark's Bay, Western Australia, whilst Ogilby records as habitat for *intermedius* "interior of New South Wales." Boulenger notes (B.M.C., i, p. 100) two specimens of *D. strophurus* from Sydney. *D. spinigerus*, *intermedius*, and *strophurus* are undoubtedly closely allied, and some of our southern specimens also show traces of the spines in the supraciliary border which distinguish Boulenger's *D. ciliaris*. This tuberculate group thus presents an interesting example of a small range of variation over a continental area, and perhaps later authorities will prefer to use trinomials for the four species.

We are indebted to Mrs. Haager for our latest specimens.

DELMA FRASERI, Gray.

Two specimens from Port Darwin, donated by Mr. Gerald F. Hill, add to Queensland Museum records of the range of this snake-like lizard. Boulenger in 1885 stated Western Australia as its habitat.¹⁹ In the Horn Expedition Reports, Lucas and Frost note "All over Australia" as its distribution.²⁰ F. R. Zietz records specimens as taken "from under fallen logs in the MacDonnell Ranges."²¹ The common Melbourne form has been figured by McCoy.²² In 1888 De Vis described two closely allied Queensland species, *Delma tincta* and *plebeia*,²³ which were separated on very slender grounds from *D. fraseri*.

¹⁶ Annals Queensland Museum, ii, 1892, p. 12.

¹⁷ Ogilby, Rec. Aus. Mus., ii, 1892, p. 10.

¹⁸ Dum. & Bibr., Erp. Gén., iii, 1836, p. 398.

¹⁹ Brit. Mus. Catalogue, i, p. 244.

²⁰ Horn Exped. Zool., ii, p. 125, 1896.

²¹ Proc. Roy. Soc. South Aus., xxxviii, p. 442, 1914.

²² Prod. Zool. Vic., dec. xvi, pl. 153, fig. 1, 1888.

²³ Proc. Lin. Soc. N.S.W., (2) ii, p. 824.

Garman's *D. reticulata*,²⁴ with dark-edged scales as in *plebeia*, was secured in the Cooktown district. His counting of fourteen scales evidently includes the ventral series, which brings it into line with De Vis' species. The type of *tincta* has the third supralabial elongated and below the eye, as in *reticulata*. When a large series is examined (the Museum has over twenty), it will be seen that little value can be placed on this and certain other characters. The second supralabial has a tendency to divide, and we have two specimens with three labials in front of the subocular on the one side and but two on the other. The longitudinal rows of body-scales (including ventrals) vary from 14 to 16, and McCoy records 18. The nasal shields also exhibit variation. Günther has stated²⁵ that "confluence of two shields into one is by no means of uncommon occurrence in this lizard" (*D. fraseri*). The type of Rosénburg's *D. lineata*,²⁶ a close ally, had the anterior part of the nasal fused with the first supralabial. Garman seems not to have been aware of De Vis' species when he described *D. reticulata*, which is certainly not distinct. *D. reticulata*, *tincta*, and *plebeia* have much the same colour markings on the head, the bars of which are very distinct in young specimens. *D. plebeia* has no median preanal scale, but it would be unwise to lay much stress on that character. In the opinion of the writer, the only satisfactory way to deal with a large series of these lizards is to regard *reticulata* as a synonym and *tincta* and *plebeia* as but variations of *D. fraseri*.

It is interesting to note that at least one of the earlier Australian herpetologists has mistaken the fore part of a *Delma fraseri* for a young brown snake, and T. S. Hall has drawn attention to the resemblance of the barred head of these lizards to the juveniles of *Diemenia textilis* as a possible case of advantageous mimicry.²⁷

It may be added that Günther, when describing *D. baileyi*,²⁸ did not endorse the separation of *Cryptodelma* as a distinct genus by Fischer on account of the presence of preanal pores, stating that "a comparison of the allied species will show that this technical character leads to a rather unnatural subdivision of the genus."

DIPOROPHORA BILINEATA, Gray.

A large series of this common lizard has been sent from Port Darwin by Mr. G. F. Hill. The remarkable variation in colour and lepidosis of this and the allied species, *D. australis*, Steind., has been pointed out by Boulenger (B.M.C., i, p. 394) and by R. Broom.²⁹ The head of *D. bilineata* is figured by N. de Rooij in her useful work, "The Reptiles of the Indo-Australian Archipelago" (Leiden, 1915, i, p. 134). *Physignathus nigricollis*, Lonnberg and Andersson,³⁰ has a most suspicious resemblance to forms of *D. australis* and is either a synonym or a curious case of convergence.

²⁴ Bull. Mus. Comp. Zool., Harv., xxxix, p. 5, 1901.

²⁵ Ann. Mag. Nat. His., xii, p. 145, 1873.

²⁶ Ann. Mag. Nat. His., xvi, p. 131, 1905.

²⁷ Victorian Naturalist, xxii, p. 74, 1905.

²⁸ Ann. Mag. Nat. His., xix, p. 170, 1897.

²⁹ Proc. Lin. Soc. N.S.W., xxii, 1897, p. 641.

³⁰ Vet.-Ak. Handl., Stockholm, Bd. 52, No. 7, p. 4, 1915.

SOME AUSTRALIAN FISH-SCALES.

BY T. D. A. COCKERELL, University of Colorado.

I AM again indebted to Dr. Hamlyn-Harris for an interesting series of scales, which are described below. It may be worth while to give a brief account of the method of preparing scales for study. We first tried mounting them in balsam, which rendered them too transparent and obscured the markings; after various trials it was discovered that dry mounts were by far the most satisfactory. The procedure is as follows:—

- (1) Remove the scales from the middle of the side of the fish, trying to avoid latinucleate (regenerated) scales.
- (2) Place the scales, while wet, on a glass slide, and cover with a cover-glass, or, if the scales are large, with a second slide.
- (3) Put on a clamp to keep the cover-glass down and in place, or, if a second slide is used, two or three clamps.
- (4) Put on two square gummed labels, each overlapping one side of the cover-glass; or, if a second slide is used, put the labels over the ends, so as to bind them together.
- (5) The next day the clamps may be removed, and the slide is finished. Scales hardly ever slip out, but it is best to keep them in flat trays or flat card-boxes.

If the scales are not mounted when removed from the fish they are best preserved dry in small paper envelopes. They must then be moistened before mounting. The apical part of the scale is covered with skin, which should usually be rubbed off.

BELONIDÆ.

Tylosurus impotens Ogilby. Moreton Bay. Scales variable, quadrate, nearly square or broader, large ones about 4.5 mm. long and broad; apical field extensive, without circuli, but frequently with irregular cracks; circuli in the basal and sublateral fields concentric, simple, or variously connected by irregular cross-lines, forming a network, the meshes of which may be very dense in the region about the nucleus. This whole system of crossed lines is of the nature of cracks or interruptions in the scale-substance, and passes into broad cracks which invade the apical field. So far as superficial appearances go, portions of the scales curiously simulate the scales of the Amphibian *Ichthyophis*. *Tylosurus acus*, from the Atlantic, differs greatly from *T. impotens* in the very broad scales, with the nucleus surrounded by circuli, which extend right across in the apical field, not leaving a large sculptureless area. In *T. acus* there are innumerable very fine radiating and transverse cracks, which have nothing to do with the circuli, and when they cross each other do not appear connected, but form a very minutely square-meshed net, as it were of independent strands.

Tylosurus schismatorhynchus Bleeker. Moreton Bay. The scales sent are small, about 2 mm. diameter, transversely elongate, nucleus apicad of middle; apical field without circuli, but with an imperfect labyrinthine pattern of minute pustuliform dots and lines, and frequently with very large cracks. Circuli fine, without any cross-lines forming a network.

The following key separates the Australian species of *Tylosurus* from the Atlantic ones, so far as my material goes :—

Circuli complete around the nucleus	.. .. .	<i>T. acus</i> (Woods Hole) and <i>T. scapularis</i> (Balboa, Panama Canal Zone).
Circuli interrupted above the nucleus, the apical field free from circuli	.. .. .	<i>T. impotens</i> and <i>T. schismatorhynchus</i> .

T. acus is the type of *Tylosurus*, if *T. cantrainii* is that species, as has been supposed. The genus should possibly be subdivided.

SPHYRÆNIDÆ.

Sphyræna obtusata Cuv. & Val. Moreton Bay. The larger scales are about 6 mm. long and 8 broad; smaller ones are about square, and probably come from near the tail. There is an exceedingly fine and dense system of circuli and radii, the basal circuli finely beaded, or rather crenulate. In the apical field the radii are lost, but the circuli continue, but become broken up in the submarginal area into irregular labyrinthiform markings. The basal radii are only about 112 microns apart.

This may be compared with *S. picuda* B. & S., from Tampa, Florida, which has the same dense radii and circuli, but the circular fibrillæ are considerably coarser and less distinctly crenulate. In both these species the radii are continuous, at least in the basal field, not moniliform or reduced to a series of pit-like structures as they are in *S. borealis* De Kay from Woods Hole. Thus the large-scaled species seem readily separable on the structure of the scales from the smaller-scaled forms such as *S. borealis*. The type of the genus has even smaller scales than *S. borealis*.

HOLOCENTRIDÆ.

Holocentrus ruber Forsk. Barrier Reef. Scales about 7 mm. long and 10 broad, the apical margin irregularly dentate; apical field pitted; five or six basal plicæ, close together, making the middle of the basal margin deeply undulate; circuli very fine and numerous; microscopical cracks forming lines as in *Tylosurus acus*. This is scarcely different from other *Holocentrus* scales. *H. microstoma* from Samoa has the marginal teeth much longer, sharper and closer, and the basal plicæ weaker and less regular. *H. laticeps* from Kauai has the teeth like those of *H. microstoma*, but the plicæ (only three or four) like those of *H. ruber*. *H. xantherythrus* from Hawaii has teeth of the same general type as *H. ruber*. *H. diadema* from Hawaii is like *H. laticeps*.

Thus, according to the scales, *H. ruber* and *xantherythrus* might be grouped together, apart from the other species mentioned.

TOXOTIDÆ.

Toxotes chatareus Ham. Buch. Norman River. Scales 6 to 8 mm. long and broad, subquadrate, but with rounded corners; circuli very fine, the lateral ones

reaching the margin at an extremely acute angle ; 7 to 10 basal radii, arranged fan-wise, the basal margin only weakly scalloped ; nucleus apicad of middle ; ctenoid patch large, occupying the whole apical field, but the elements very small, the marginal teeth extremely minute. The ctenoid structures are modified circuli, into which they can be seen to pass ; they appear to be, in fact, crowded segments of circuli, all much longer than broad.

These scales suggest those of *Anabas*, but differ as follows :—Basal radii less numerous, and not nearly so close together ; lateral circuli much finer and denser ; no circuli meeting at an angle above the nucleus ; ctenoid patch much more extensive ; apical teeth much smaller. The *Anabas* examined are *A. muniti* from Egypt and *A. scandens* from the Philippine Islands.

There are many families in which the scales are of the same general type as those of *Toxotes*, but in no case, so far as my material shows, is the resemblance very close.

SERRANIDÆ.

Interpreting this family in a broad sense, the following may be included :—

- Radial system consisting of a more or less elongate ring in the nuclear region, from which proceed strong radii, the basal ones many and long, the apical ones short ; circuli extremely fine
Plesiops nigricans Rupp.
(Moreton Bay).
- Radii ordinary, all basal ; no nuclear ring 1.
1. Scales broader than long ; basal radii 4 to 6 ; apical circuli transverse ; scales wholly cycloid . .
Ambassis nalua Ham. Buch.
(Cape Bowling Green).
- Scales longer than broad, with ctenoid elements, though not always with marginal teeth . . 2.
2. Ctenoid patch large, marginal teeth numerous and well developed ; scales moderately broad . .
Plectroplites ambiguus Rich.
(Condamine River).
- Ctenoid patch small, marginal teeth few or absent, scale narrower 3.
3. Ctenoid (tooth or spine like) elements only developed in a patch just above the nucleus, the region beyond with broken remains of circuli, more or less V-shaped, consequently no apical teeth whatever
Epinephelus lanceolatus Forsk.
(Moreton Bay).
- Ctenoid elements reaching the margin, where there are projecting spine-like teeth ; scales small and very narrow
Oligorus macquariensis C. & V.
(Condamine River).

It will be seen that at least three entirely different types of scale are represented here. It must be stated, however, that some *Plesiops* scales (*P. corallicola*, Eton Is.) have the nucleus very near the apex, with long radii proceeding fan-wise basad from it, no radial ring and no apical radii. In *P. corallicola* scales, whether as just described or with the radial ring and apical as well as basal radii, there are strong ctenoid elements on the apical margin, with many sharp teeth. In *P. nigricans* the ctenoid features are less distinct, largely concealed by the dark skin. According to Boulenger, *P. corallicola* is not to be separated from *P. nigricans*.

Ambassis constitutes a very distinct group, Ambassinæ or Ambassidæ. Other species of *Epinephelus*, as *E. niveatus* and *E. megachir*, have very strongly developed apical teeth, so *E. lanceolatus* appears to be an aberrant species. *Oligorus* scales closely resemble those of *Epinephelus niveatus* C. & V., from the Atlantic.

APOGONIDÆ.

I do not believe that the rules, correctly interpreted, require us to write *Amia* for *Apogon*.

Glossamia aprion Rich. Norman River. Scales transversely oval or oblong, about 4 mm. long and 5 broad, some a little larger; corners rounded; nucleus a short distance above middle; basal radii delicate and numerous; basal margin only feebly crenulated; radii above the nucleus complete, rounded, not angled; ctenoid patch very distinct, the elements elongated; marginal teeth numerous, small. The submarginal ctenoid elements are much longer and more spine-like than in *Cheilodipterus nigrotæniatus* Sm. & Rad. (U. S. Nat. Mus.; type).

Apogon fasciatus Shaw. Moreton Bay. Scales transversely elongated, about 4.5 to 5.5 mm. long and 5.5 to 6.5 mm. broad; differing conspicuously from *Glossamia* in the subapical nucleus (which, with the obtusely angulate apical margin, recalls the Gobiidæ, although the ctenoid elements are in many rows), and also in the deeply crenulate basal margin. The marginal teeth are small and very sharp; the submarginal ctenoid elements are relatively broad and short, of the same general type as those of *Cheilodipterus*. In this last feature *Apogon*, *Cheilodipterus*, and *Apogonichthys* fall together, apart from *Glossamia*.

Through the kindness of Dr. H. M. Smith I have scales from the types of a number of species of *Apogon* (*Amia* S. & R.) lately published by Smith and Radcliffe. They entirely confirm the generic characters ascertained from *A. fasciata*. In *A. uninotatus* (S. & R.) the scales are unusually short and broad, and the basal circuli are very fine and close. There are good specific characters in the structure of the ctenoid elements, which are hard to describe. I figure those of *A. uninotatus*, *A. nigrocinctus*, and *A. fasciatus*.

HÆMULIDÆ.

Pomadasis hasta Bloch. Moreton Bay. Scales subquadrate, about 5 mm. broad and long, the nucleus far above the middle; basal radii ordinary, about 12; basal margin moderately crenulate; ctenoid area large, marginal teeth small and sharp; ctenoid elements much like those of *Apogon nigrocinctus*, the submarginal elements as broad as long, much as in the Percid *Boleosoma*. There is no material difference from the scale of *Orthopristis*. *Pomadasis macracanthus*, from Balboa, Panama Canal Zone (Meek and Hildebrand, U.S. N.M.), presents no material difference in the scales. The *Pomadasis* scale represents a very conservative acanthopterygian type.

THERAPONIDÆ.

Therapon fuliginosus Macleay. Burdekin River. Scales longer than broad, about 6 mm. long and 4.5 broad, but variable; about 12 to 15 basal radii; basal margin scarcely crenulate; ctenoid patch large.

T. unicolor Gthr. Burnett River. Scales little longer than broad, or even sometimes broader than long, the largest not over 5 mm. long; basal margin hardly scalloped or crenulate.

T. percoides Gthr. Walsh River. Scales square, about as broad as long, the largest about 4 mm. long; basal margin finely scalloped.

T. jarbua Forsk. has the smallest scales, according to my material, with the basal margin distinctly scalloped.

All these keep the generic characters indicated for *T. jarbua* in Mem. Queensl. Mus., vol. ii, p. 56. They are very ordinary acanthopterygian scales, distinguished from those of *Pomadasis* by the closer basal radii.

SPARIDÆ.

- | | | |
|--|--|----|
| Lateral circuli transverse or somewhat oblique | .. .. . | 1. |
| Lateral circuli vertical, or if oblique, more nearly vertical than transverse | .. .. . | 2. |
| 1. Upper lateral circuli broken into interrupted lines, irregular and often hooked at end; radii five or six, none reaching lateral margins | <i>Pentapus aurifilum</i> Ogilby
(Off Cape Moreton). | |
| Lateral circuli entire, normal, but there is an area between the uppermost circuli and the ctenoid area which is entirely free from sculpture | <i>Dentex spariformis</i> Ogilby
(Off Cape Moreton). | |
| 2. Basal radii six to nine, none reaching lateral margins; region above level of nucleus with some small perforations; ctenoid structures as in <i>P. aurifilum</i> , but submarginal elements shorter | <i>Pentapus setosus</i> C. & V.
(Moreton Bay). | |
| Some of the radii reaching lateral margins (not always in <i>Sparus australis</i>) | .. .. . | 3. |
| 3. Lateral circuli oblique, forming an angle of perhaps 30 degrees with margin; ctenoid elements weak | <i>Sparus australis</i> Gthr.
(Moreton Bay). | |
| Lateral circuli vertical, parallel (or almost parallel) with margin | .. .. . | 4. |
| 4. Scales quadrate, about as broad as long; ctenoid patch large; submarginal ctenoid elements elongate | <i>Lethrinus glyphodon</i> Gthr.
(Moreton Bay). | |
| Scales broader than long (some are square in <i>Gymnocranius</i>) | .. .. . | 5. |
| 5. Submarginal ctenoid elements elongated | <i>Lethrinus nebulosus</i> Forsk.
(Moreton Bay). | |
| Submarginal ctenoid elements short; scales larger | <i>Gymnocranius bitorquatus</i> Ogilby
(Moreton Bay). | |

The characteristic ctenoid elements of *Lethrinus* (*L. harak*) were described in Mem. Queensl. Mus., vol. ii, p. 56. The additional species agree.

The two species of *Pentapus* in the above key seem to be subgenerically distinct. The European *Dentex vulgaris* has the lateral circuli oblique, practically as in *Sparus australis*; it is very different from *D. spariformis*, which is perhaps not congeneric. *Sparus sarba* has the upper lateral circuli quite transverse, but the lower ones are oblique.

CHÆTODONTIDÆ.

Holacanthus nox Bleeker. Barrier Reef. Scales small, the ctenoid area with strong continuous ridges, ending in teeth. In Mem. Queensl. Mus., vol. iii, p. 44, it is stated (whether by a slip of the pen or a misprint I do not know) that *H. bicolor* has small separate elements in the basal part of the ctenoid area. The statements there made (section 4) refer not to *H. bicolor* but to *H. sexstriatus*. The next section (5) properly refers to *H. bicolor*. *H. nox*, at least in some scales, has very distinct basal radii, with the basal margin strongly scalloped.

Holacanthus imperator has complete rods in the ctenoid area, as in *bicolor* and *nox*.

MONACANTHIDÆ.

Cantherines trachylepis Gthr. Moreton Bay. The thick skin is minutely pigment-dotted, and out of it arise, at regular intervals, the rows of five (rarely four) sharp short spines representing the scales. The scales are expanded beneath the skin, the concealed portion consisting of coarse fibrillæ, which give it a striated appearance. These scales are not like those of *Monacanthus* or *Ceratacanthus*; they are rather more suggestive of *Balistes*.

SCORPÆNIDÆ.

Apistus macrolepidotus Ogilby. Hervey Bay. Scales elongate, 3 to 4 mm. long, 1.75 to 2.25 mm. broad; sides approximately parallel; nucleus far above middle; circuli dense; basal radii about 10 to 12, strong; basal margin scalloped; apical margin with immense irregular teeth, supported by median slender ribs, these teeth four to eight, or occasionally only three, one sometimes larger than the others. This is a very unique and remarkable scale, remotely approaching *Sebastes*.

I take the opportunity to note that *Pterois lunulata* Schleg., from Misaki, Japan (Stanford University), has short scales, about as broad as long, of the same type as those of *Scorpæna plumieri* Bl., but whereas in the *Scorpæna* there are rudimentary denticles, in the *Pterois* the scale is strictly cycloid, with the transverse apical circuli zigzag or strongly wavy.

DACTYLOPTERIDÆ (CEPHALACANTHIDÆ).

Ebisinus procne Ogilby. Moreton Bay. These scales have a sharp central keel and a dentate margin, entirely in the manner of *Cephalacanthus volitans*. The marginal teeth number about ten.

PTEROPSARIDÆ.

Parapercis nebulosa Quoy & Gaim. Moreton Bay. Scales like those of *P. cylindrica*, but considerably longer.

SOLEIDÆ.

Brachirus niger Macleay. Moreton Bay. Scales greatly elongated (about 4.25 mm. long and 1.50 broad), parallel-sided, nucleus far above the middle, basal radii about 6 to 10; apical teeth about 8 to 12, long and sharp. These scales are from the pigmented side of the fish. The ctenoid elements are quite as in *Solea*, with the same characteristic submarginal structures (see fig. 49, Bull. U.S. Bur. Fish, xxxii, p. 172).

ICHTHYOLOGICAL ITEMS.

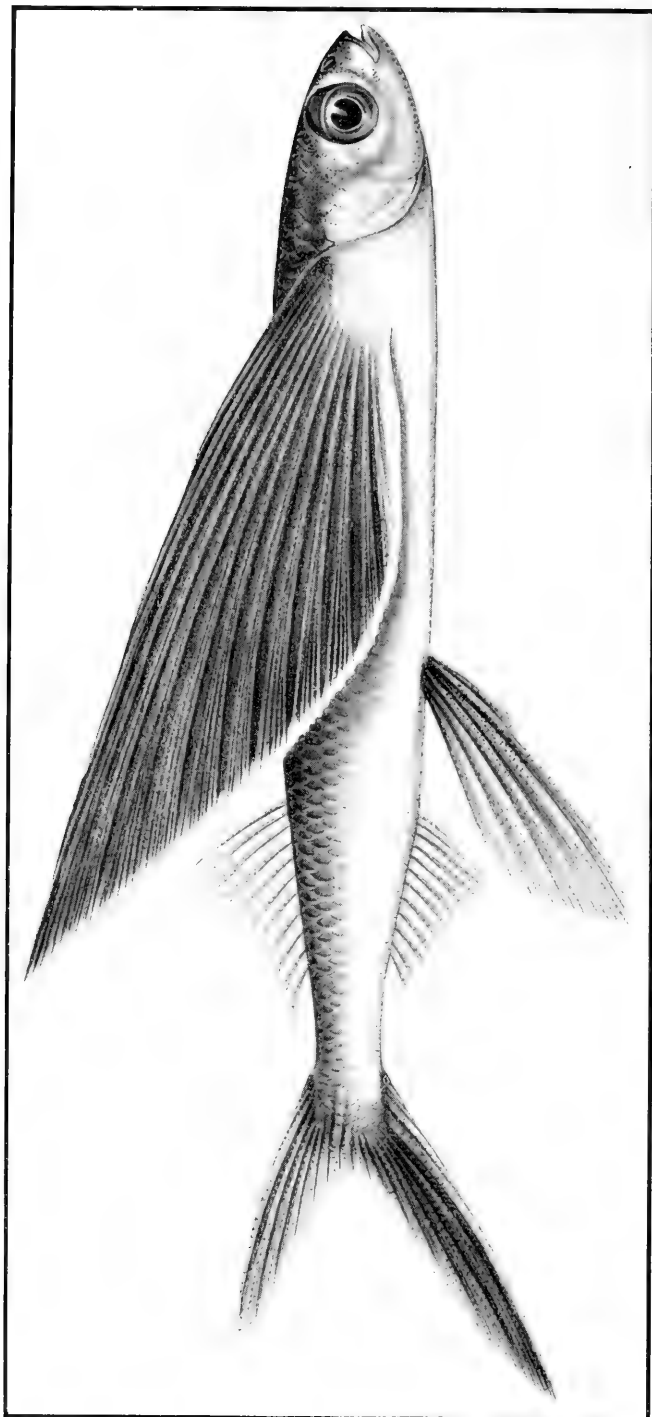
By ALLAN R. McCULLOCH, Zoologist, Australian Museum.

(Plates VII. to IX. and Four Text-figures.)

THE following contribution consists of miscellaneous notes on fishes which have come to hand from various sources. In the endeavour to elucidate some of the problems relating to our fishes, many scraps of information concerning them are accumulated, which, though disconnected and imperfect in themselves, serve as stepping-stones towards the greater object in view. Some of these, together with descriptions of several species, are therefore submitted as items of ichthyological interest.

A feature which largely facilitates the accumulation of these notes is the advancement in recent years of our several Australian museums, and the vastly improved condition and storage of their contained collections. An appreciation of the extreme importance of typical specimens and of others which have been described or illustrated in literature has been generally developed, and invaluable material, hitherto largely neglected or lost in a maze of unsorted miscellanea, has been rediscovered and valued at its proper worth. Faded and dilapidated remains of specimens, valuable only because of their history, have been given pride of place over others more showy and of more general interest. This improvement has come none too soon, since not a few types and other specimens of equal value have either been lost or are decayed beyond redemption. It is fortunate for Australian ichthyology that the specimens on which Castlenau, Macleay, de Vis, and Johnston founded their numerous species are now being diligently sorted out of the various collections in which they are contained, and made available for examination.

Intimately associated with this advancement is a freer interchange of material between the various institutions in the different States. Until recently, ichthyological papers published in Australia have dealt almost exclusively with limited collections, and large series for comparative study and illustrating variation have been rarely obtainable. The conditions having improved, however, the collections of all the museums may now be called upon when occasion demands such a course. Ever ready to assist in this direction is Dr. R. Hamlyn-Harris, Director of the Queensland Museum, to whom I am indebted for many courtesies, and it is due to him that I have been able to investigate some of the matters referred to in the following pages. I also wish to express my thanks for the loan of specimens to Mr. Edgar R. Waite, Director of the South Australian Museum; to Mr. J. A. Kershaw, Curator of the National Museum, Melbourne; and to Mr. W. B. Alexander, Keeper of Biology, Western Australian Museum.



CYPSSELURUS CRIBRICOSTUS Kner. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

FAMILY EXOCETIDÆ.

GENUS CYPSELURUS, Swainson.

CYPSELURUS (EXONAUTES) CRIBROSUS, Kner.

(Plate VII.)

Exocætus unicolor? Cuv. & Val., *vel cribrosa*, Kner, Reise "Novara," Zool., i., Fische, 1867, p. 325. (Not *E. unicolor*, Cuv. & Val.)

Exocætus dovii, Ogilby, Mem. Austr. Mus., ii., 1889, p. 71. (Not *E. dovii*, Gill.)

Exonautes rondeletii, Waite, Rec. Austr. Mus., v., 1904, pp. 156 and 195. (Not *E. rondeletii*, Cuv. & Val.)

Exonautes unicolor, Jordan, Study of Fishes, 1905, i., fig. 226, and ii., p. 213. (Not *E. unicolor*, Cuv. & Val.)

Cypsilurus unicolor, Jordan & Seale, Bull. U. S. Fish. Bur., xxv., 1906, p. 209, fig. 12. (Not *E. unicolor*, Cuv. & Val.)

Exonautes fulvipes, Ogilby, Proc. Roy. Soc. Qld., xxi., 1908, p. 8.

Exonautes cribrus, Ogilby, *loc. cit.*, p. 13.

Two specimens, 232-235 mm. long from the snout to the middle caudal rays, only differ from the description of *C. cribrus* in having longer pectorals, which reach almost to the base of the caudal. According to Kner, they only extend to the anal in *C. cribrus*, but as he compared that species with *C. unicolor* and *C. rondeletii*, both of which are long-finned species, it is probable his "Anale" is a misprint for "Caudale."

I have compared them with the type of *C. fulvipes* from Lord Howe Island, and find them identical, while the fish figured by Jordan as *C. unicolor* is also apparently the same species.

When fresh, these two specimens were deep ultramarine blue above and silver below; the pectorals are dark without lighter cross-bands, but their margins and lowermost rays are pure white; the ventrals are light-coloured, the rays being either a little dusky, or white with darker margins; caudal with lighter margins, the lower lobe a little darker than the upper. The pectoral fins reach either to the base of the caudal or only to the end of the dorsal; the ventrals also vary slightly in length. The anal may be as long as or shorter than the dorsal, and both fins may have either eleven or twelve rays each.

Loc.—Off Port Hacking, New South Wales, 26th July, 1915.

FAMILY SOLEIDÆ.

GENUS ASERAGGODES, Kaup.

ASERAGGODES HAACKEANA, Steindachner.

Solea (Achirus) haackeana, Steindachner, Anz. Akad. Wiss. Wien, 1883, p. 195, and Sitzb. Akad. Wiss. Wien, lxxxviii. i., 1884, p. 1104, pl. i., fig. 3.

Solea (Aseraggodes) textilis, Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales, (2), i., 1886, p. 6.

A comparison of the type of *Solea textilis* with Steindachner's description and figure of *S. haackeana* shows that they represent the same species. The former is described as having the lower eye slightly in advance of the upper, but this is incorrect.

This species belongs to the genus *Aseraggodes*, having no pectoral fins, the ventrals subequal and free from the anal, and the vent on the median line of the body.

GENUS SOLEICHTHYS, Bleeker.

SOLEICHTHYS HETERORRHINOS, Bleeker.

Solea heterorhinus, Bleeker, Atlas. Ichth., vi., 1866-1872, p. 17, pl. cexl., fig. 2. *Id.*, Kent, "Great Barrier Reef," 1893, p. 297, pl. xvi., fig. 5.

Solea lineata, Ramsay, Proc. Linn. Soc. N. S. Wales, vii., 1883, p. 406.

The typical specimen of *Solea lineata* is preserved in the Australian Museum, though it is in very bad condition and has lost some of its fins. It does not differ from an Indian example of *S. heterorhinus*, and proves Ramsay's description to be inaccurate in several details. He described the pectorals as about twice as long as the head, whereas the right is much longer than the left, and is only about half as long as the head. He counted 120 scales on the lateral line; I find about 109 on its straight portion as far as the hypural. Ramsay described the posterior dorsal and anal rays as produced; these have since been lost, so that this detail cannot now be checked.

S. heterorhinus has been recognised from Thursday Island, Torres Strait, by Kent. Ramsay's type was collected at Port Stephens, New South Wales.

GENUS SYNAPTURA, Cantor.

Brachirus, Swainson, Nat. Hist. and Classif. Fishes, ii., 1839, p. 303 (? preoccupied by *Brachyrus*, Swainson, *loc. cit.*, p. 264).

Synaptura, Cantor, Cat. Malay. Fish., 1850, p. 222 (a substitute for *Brachirus*, considered to be preoccupied).

Nomenclature.—I am indebted to Professor David Starr Jordan for the following note on the use of the name *Synaptura* in preference to that of *Brachirus*. He writes: "I would say that *Brachirus* Swainson, 1839, p. 303, is antedated by *Brachyrus* Swainson, p. 264. Both mean *Brachychirus* apparently." This opinion, it must be noted, is in contradiction to that expressed by Jordan and Evermann¹ in regard to *Scaphirhynchus* and *Scaphorhynchus* when they wrote: "We regard all generic names not spelled alike as distinct." The matter being open to doubt either way, I follow Professor Jordan in adopting Cantor's *Synaptura*, which is in common use.

Key to the species here described.

a. Interocular space scaly.

b. Upper pectoral fin shorter than the eye.

c. Body with numerous dark cross-bars

cc. Body without cross-bars *fasciatus*.

bb. Upper pectoral fin longer than the eye *breviceps*.

aa. Interocular space naked. Body with cross-bars.

d. Pectorals rudimentary. Scales smaller, l. lat. 112-130. Less than twenty cross-bars .. *salinarum*.

dd. Pectorals short. Scales larger, l. lat. 90. Twenty or more cross-bars .. *cancellatus*.

SYNAPTURA CANCELLATA, sp. nov.

(Plate VIII., fig. 1.)

D. 75; A. 67. L. lat. 112 from the operculum to the hypural; L. tr. 35/1/47. Greatest depth 2.8 in the length from the snout to the hypural; head 6.7 in the same. Eye about 4, posterior dorsal and anal rays 1.5, median ray of right ventral about 3 in the head; caudal fin almost as long as the head.

¹ Jordan and Evermann, Bull. U. S. Nat. Mus., No. 47, part i., 1896, p. 107.

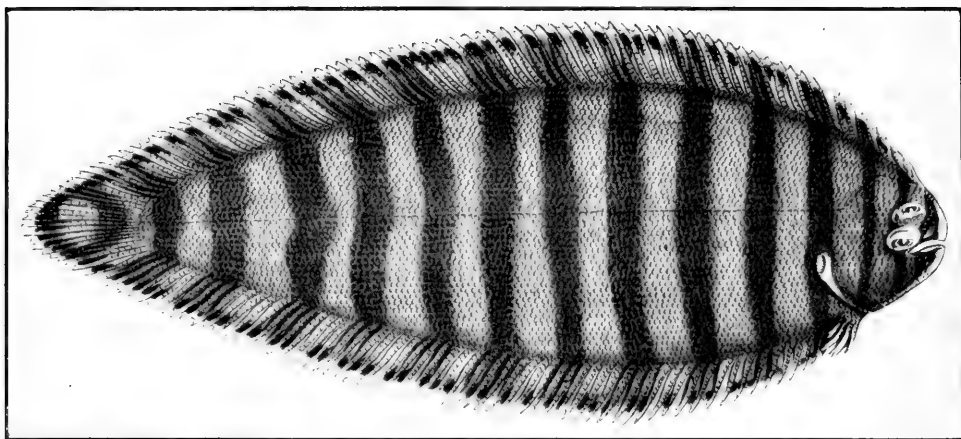


Fig. 1.—*SYNAPTURA CANCELLATA* McCulloch.

A. R. McCulloch, del.

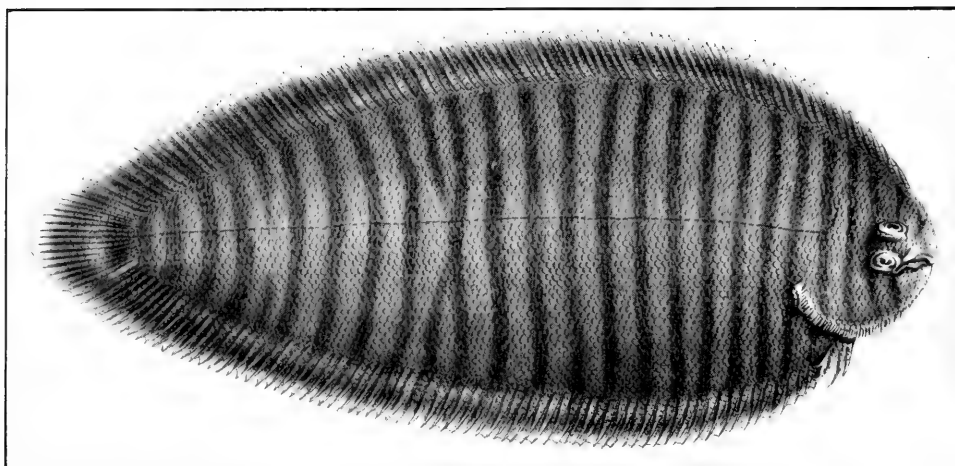


Fig. 2.—*SYNAPTURA FASCIATA* Macleay. $\frac{5}{8}$ Nat. Size.

A. R. McCulloch, del.

Face page 61.

Scales ctenoid above and below, and extending onto the fin-rays. Head closely scaly above, without cirri; lower surface with many minute cirri projecting from between the scales, while the margin of the gill-opening is closely fringed with them. Eyes rather large, without any scaly interorbital space; the upper is in advance of the lower. Upper anterior nostril forming a short, simple tube, the posterior in a minute tube directly before the eye; lower anterior nostril with a low skinny border, placed above the middle of the lip, the posterior in a tube beneath the hinder portion of the upper eye. Teeth minute, apparently present on the blind side only. Mouth opening backward to below the anterior third of the eye; lower lip not fringed. Gill-membranes with skinny flaps which unite with the rudimentary pectorals to form broad tubular openings.

Dorsal fin commencing a little before the middle of the eye; the rays increase regularly in length backwards, and their tips are bifurcate and project slightly beyond the membrane. Anal of similar form to the dorsal. Caudal rounded. Ventrals opposite each other, and free from the anal; they each have four rays, of which the second is longest, but the left ventral is only half as large as the right. Pectorals rudimentary, of equal size, the longest ray about half as long as the eye; they are united with the gill-membranes as described above. Lateral line straight from the back of the head to the median caudal rays; on the upper side it curves upward and forward to the front margin of the head.

Colour.—Light brown above with fifteen cross-bars on the head and tail; the first is broad and largely covers the snout; second and third narrow, the former passing through the eyes and the latter across the operculum; the remainder increase in width backwards and are about as wide as the interspaces. Dorsal, anal, and caudal each with a white margin, followed by an interrupted black submarginal band; the cross-bars of the body are also continued onto the fins. Blind side colourless.

Described and figured from a specimen 193 mm. long. Five others exhibit some variation in their colour-marking; the cross-bands vary in number up to nineteen, and some may be interrupted and irregular; in some specimens the white margins of the fins are very narrow. The dorsal rays vary from 71-81, and the anal 64-70, while there are from 112-130 scales on the lateral line.

Loc.—Neighbourhood of Fremantle, Western Australia.

SYNAPTURA FASCIATA, Macleay.

MANY-BANDED SOLE.

(Plate VIII., fig. 2.)

Synaptura fasciata, Macleay, Proc. Linn. Soc. N. S. Wales, vii., 1882, p. 14. *Id.*, Waite, Mem. Austr. Mus., iv., 1, 1899, p. 126, pl. xxxi.

D. 75-87; A. 65-74; C. 15-16; V. 4. L. lat. 92-96; L. tr. 27/1/36. Greatest depth 2.5 in the length from the snout to the hypural; head about 6 in the same. Eye about 4, posterior dorsal and anal rays 1.5, longest ventral ray 3.2, and caudal fin 1.2 in the head.

Scales ctenoid above and below, and extending onto the fin-rays. Head closely scaly above with a few cirri on the anterior portion, and many on both its dorsal and ventral profiles, and on the margin of the gill-opening; lower surface of head closely covered with cirri which leave only the middle of the operculum bare (in spirit-specimens the cirri are much shrunken, and not easily detected). Eyes of moderate

size, separated by a scaly interorbital space; the upper is in advance of the lower. Upper anterior nostril in a simple tube which may reach the anterior margin of the lower eye; posterior nostril in a tube directly before the eye: lower anterior nostril above the upper lip, with a raised skinny margin; the posterior in a tube beneath the upper eye. Teeth in a band on the left ramus of each jaw. Mouth opening backwards to below the anterior fourth of the eye; lower lip with a few tentacles, but not fringed. Gill-membranes projecting posteriorly, and uniting with the rudimentary pectorals to form broad tubular openings.

Dorsal fin commencing slightly before the anterior margin of the eye; the rays increase regularly in length backward, and are all simple, with their tips projecting slightly beyond the membrane. Anal of similar form to the dorsal. Caudal rounded, its rays simple. Ventrals opposite each other and subequal, the second rays longest. Pectorals rudimentary, subequal, with a few short rays which are less than half as long as the eye; they are united with the gill-membranes as described above. Lateral line straight from the back of the head to the median caudal rays; on the upper side, it curves upward and forward to the front margin of the head.

Colour.—Dark brown above, with from twenty-two to twenty-four darker cross-bars on the head, body, and tail, which are narrower than the interspaces. The margins of the dorsal, anal, and caudal fins are lighter than the remaining portions, and the cross-bars of the body are also faintly indicated on the fins.

Described from two specimens 190-200 mm. long; the figure represents the larger specimen. I have compared these with Macleay's type, and find them to be structurally identical in all details except the formation of the upper anterior nostril; in the type, this is bilobed instead of simply tubular, but I regard this as being probably abnormal. The specimen described and figured by Waite is preserved in the Australian Museum; it only differs from mine in having fewer cross-bars on the body.

Locs.—I have examined five specimens from the northern portion of the New South Wales coast as follows:—

Eight miles N. 10° E. of the north head of the Richmond River, 16-18 fathoms;

Eleven miles S. × E. from Ballina, Richmond River, 28 fathoms;

Eleven miles north of Cape Byron, 27 fathoms.

SYNAPTURA CRATICULA, sp. nov.

(Plate IX., fig. 1.)

D. 73-79; A. 62-67; V. 4; C. 17-18. L. lat. 90; L. tr. 30/1/38. Depth 2.3-2.4 in the length from the snout to the hypural; head 6.3-6.5 in the same. Eye 3.3-3.1, posterior dorsal and anal rays 1.5-1.7, longest ventral ray 2.2-2, and caudal fin 1.1-1 in the head.

Scales ctenoid above and below, and extending onto the fin-rays. Head closely scaly above, without cirri; lower surface with cirrhose scales on the anterior portion, and numerous cirri on the lower profile and along the margin of the gill-opening. Eyes rather large, contiguous, and raised above the head; the upper is very slightly in advance of the lower, and there is no scaly interorbital space. Upper anterior nostril in a simple tube, which just reaches the anterior margin of the eye; lower anterior nostril not dilated. Microscopic teeth are present on the blind side

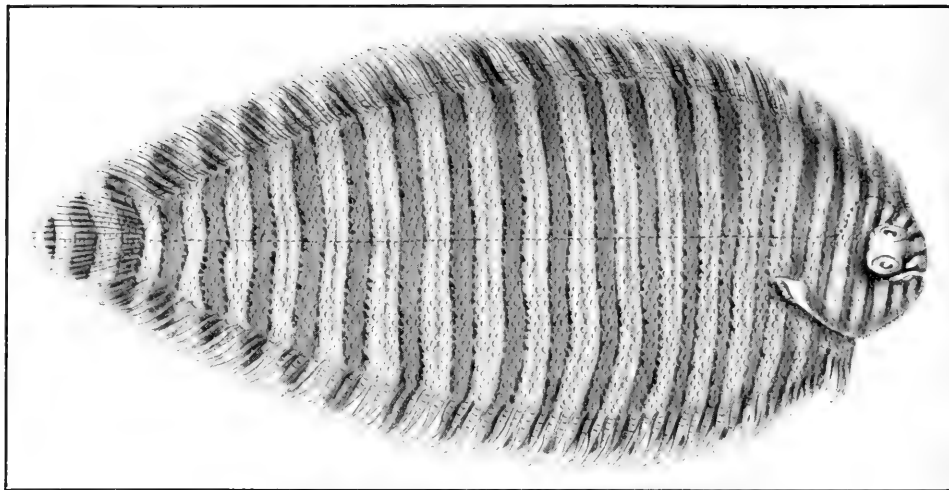


Fig. 1.—*SYNAPTURA CRATICULA* McCulloch. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

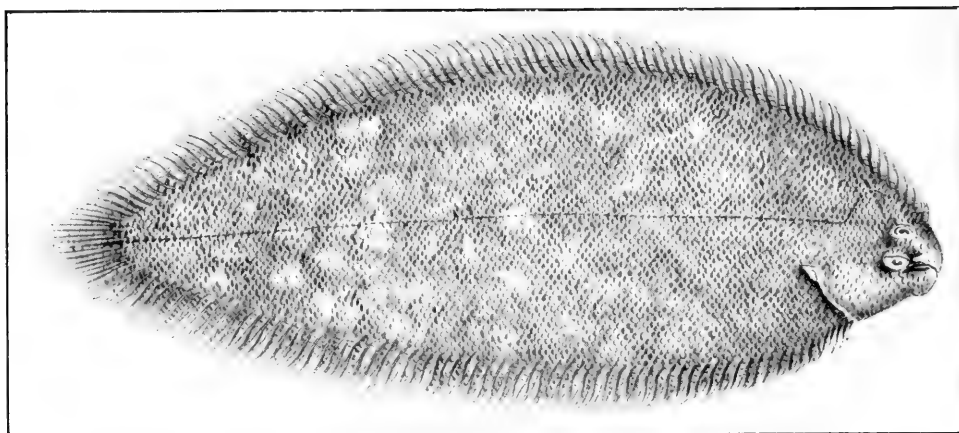


Fig. 2.—*PHYLLICHTHYS SCLEROLEPIS* Macleay. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

Face page 63.

only. Mouth opening backward to below the anterior third of the eye; lower lip with a few tentacles, but not fringed. Gill-membranes dilated posteriorly, and united with the pectorals.

Dorsal fin commencing slightly before the anterior margin of the eye; the rays increase regularly backwards, and are bifurcate, with their tips free. Anal of similar form to the dorsal. Caudal rounded. Ventrals opposite each other, and free from the anal; the right is nearly twice as long as the left. Pectorals subequal, or the right slightly larger than the left; the longest rays are half or less than half as long as the eye. Lateral line straight from the back of the head to the median caudal rays; on the upper side it curves upward and forward to the front margin of the head.

Colour.—Light brown above, with twenty to twenty-four dark cross-bands, which are about as wide as the interspaces, and have their margins defined by series of blackish dots; the interspaces also are crossed by narrow, indistinct bands. The bands are continued onto the fins, and the dorsal and anal are also marked with a few dark blotches near the margins.

Described from two specimens 148-159 mm. long; the smaller is selected as the type, and is figured.

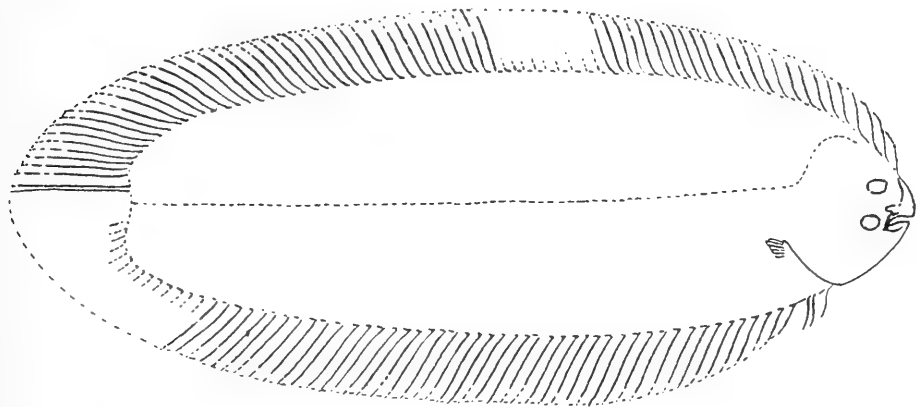
The subequal pectoral fins readily distinguish this species from the closely allied *S. zebra*.

Loc.—Near Bowen, Queensland.

SYNAPTURA BREVICEPS, Ogilby.

Brachirus breviceps, Ogilby, Proc. Roy. Soc. Qld., xxiii., 1910, p. 36.

D. 73; A. 61; C. ?; P. dex. 6?, sin. ?; V. ?. L. lat. 77; L. tr. 25/31. Greatest depth, measured on the lower surface, 3 in the length to the base of the caudal rays; head 5.7 in the same. Eye 6.8 in the head, and equal to the interocular



Text-fig. 1.

SYNAPTURA BREVICEPS Ogilby. Nat. Size.

space. Longest ray of right pectoral fin shorter than the eye, 7.3 in the head, and shorter than that of the left pectoral, which is 5.4 in the head. Caudal ray equal to the length of the head.

Scales ctenoid above and below except on the lower surface of the head, where they are cycloid; the upper surfaces of the fin-rays are scaly, but the lower are naked in the type. All the upper portion of the head, except the lips and anterior half of the snout, is scaly; the naked portion is separated from the rest by a fold of skin which crosses the snout and is connected with the anterior dorsal ray: lower surface of head naked anteriorly, with scattered cirri. Eyes small and round, the upper partly in advance of the lower; interorbital space scaly. Upper anterior nostril with a tentacle which does not reach back to the anterior margin of the lower eye, and which has a minute, inferior, secondary lobe at its base; posterior nostril opening into a short tube placed near the lip in front of the eye. A band of microscopic teeth on the left side of each jaw. Mouth opening backward to the anterior margin of the lower eye; lips not fringed.

Fins imperfect in the type. Dorsal commencing in advance of the upper eye; its rays increase in length backward, the posterior ones being almost as long as those of the caudal. Anal similar to the dorsal. Caudal incomplete. The ventrals are much damaged, and partly wanting; they were evidently opposite each other and subequal anteriorly, and separated from the anal by a short interspace. Pectorals minute, the left a little larger than the right. Lateral line straight from the middle caudal rays to the back of the head; it is arched upward and forward on the upper surface of the head.

Colour.—Uniform greyish brown after long preservation.

Described from the type of the species which was lent me for the purpose by Dr. R. Hamlyn-Harris, Director of the Queensland Museum. It is in very bad condition, and its fins are so damaged that the details of their structure cannot now be determined, but enough is left to show that they are not altogether in accordance with Ogilby's description. The left pectoral is longer instead of shorter than the right. The ventrals are so imperfect that their form and extent cannot be made out, but the anterior rays of each are present and are close together and subequal; the second ray of the left fin is also present, and well developed, so that the fin cannot be described as "atrophied." Some of the dorsal and anal rays are missing, and those remaining are so shrivelled that I am unable to measure them satisfactorily; the outlines of these fins in the accompanying figure may therefore not be correct.

Loc.—Rockhampton, Queensland.

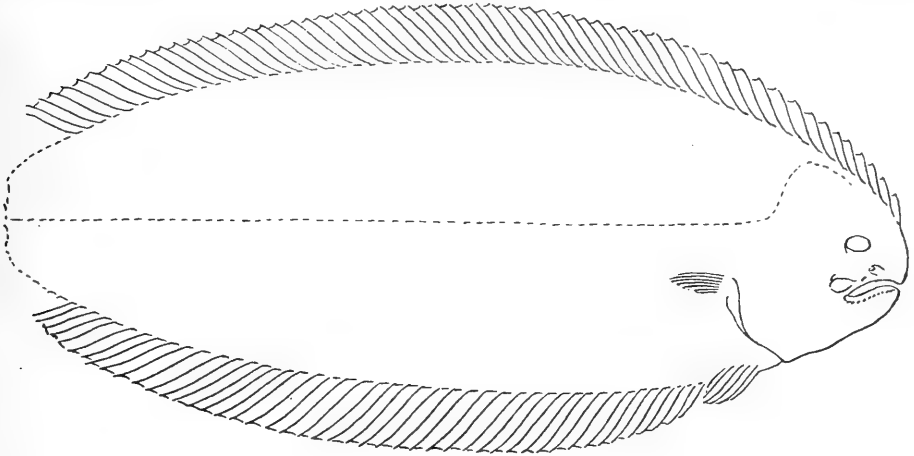
SYNAPTURA SALINARUM, Ogilby.

Brachirus salinarum, Ogilby, Proc. Roy. Soc. Qld., xxiii., 1910, p. 35.

D. 63 + ?; A. 47 + ?; C. ?; P. 7-8; V. 6. L. lat. c. 97; L. tr. 33/42. Greatest depth, measured on the lower surface, 2.8 in the length to the base of the caudal rays; head 5.1 in the same. Eye 7.2 in the head, and less than the interocular space, which is 6 in the head. Pectoral fins 2.8, median dorsal rays 2.6, and median ventral rays 2.6 in the head.

Scales ctenoid above and below, and extending onto the fin-rays on both surfaces. Upper surface of head scaly to the tip of the snout: lower surface with fringes of cirri on the anterior third which extend backward near the lower border, while smaller cirri define a series of mucous canals which are arranged in the manner

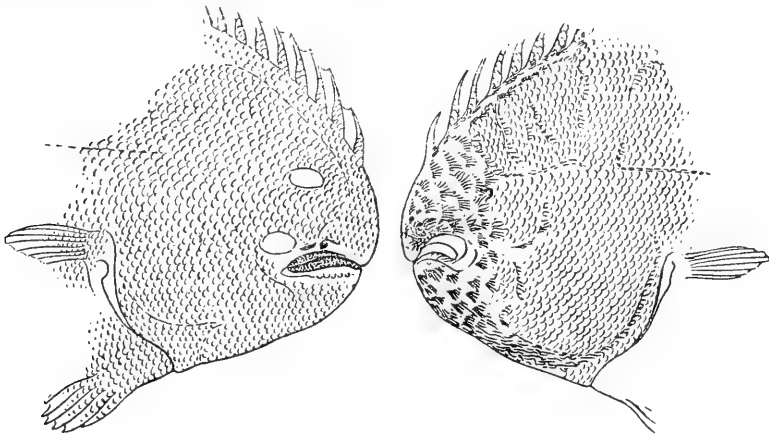
shown in the accompanying figure ; the intervening spaces are scaly. Eyes small, the upper being half its length in advance of the lower ; interocular space scaly, a little more than an eye-diameter wide. Upper nostrils near the lip, the anterior



Text-fig. 2.

SYNAPTURA SALINARUM Ogilby. Nat. Size.

in a short tube which does not reach backward to the posterior ; lower anterior nostril hidden in a bunch of cirri above the middle of the upper lip, the posterior in a tube beneath the upper eye. Microscopic teeth on the left side of each jaw. Mouth rather large, reaching backward to below the middle of the lower eye ; lower lip with some minute tubercles, not fringed.



Text-fig. 3.

SYNAPTURA SALINARUM Ogilby. Upper and under surfaces of head $\times 3$.

Dorsal fin commencing above the middle of the snout : its rays increase to the middle of its length, and then decrease again backward ; its posterior portion is

missing in the type. Anal similar to the dorsal, its terminal portion also lacking. Caudal missing. Pectoral fins well developed, subequal; the middle rays are longest, and more than twice as long as the eye. Ventrals subequal, opposite each other, the median rays longest and overlapping the anterior anal rays; the hinder rays of each appear to have been attached to the body by membrane, which is now torn, leaving them free.

Colour.—Stained green in preservative, with traces of darker markings. Dorsal and anal fins with lighter margins; pectorals dark.

Described from one of the typical specimens lent me for examination by the Director of the Queensland Museum. It is 123 mm. long without the caudal fin. Ogilby's brief description was prepared from two specimens, both of which were mutilated, the tails and the ends of the dorsal and anal fins being broken off. He counted sixty-six dorsal and fifty-three anal rays, while the proportions he gave are somewhat different from those of the specimen I have described. He counted only eighty-four scales, whereas I find about ninety-seven directly below the straight portion of the lateral line.

Loc.—Salt pans at Kimberley, North Queensland.

GENUS PHYLlichTHYS, gen. nov.

Allied to *Synaptura*, but differing in having the ventral fins more or less united by membrane, and the right ventral completely joined to the first anal ray; vent placed in front of the anal fin, but slightly to the left of the median line.

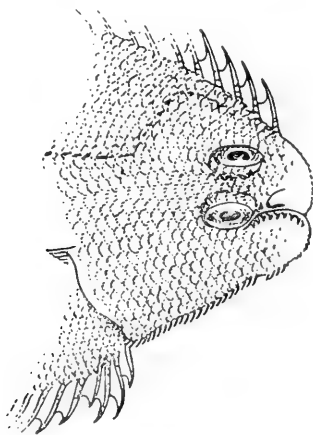
Type.—*Synaptura sclerolepis*, Macleay.

PHYLlichTHYS SCLEROLEPIS, Macleay.

(Plate IX., fig. 2.)

Synaptura sclerolepis, Macleay, Proc. Linn. Soc. N. S. Wales, ii., 1878, p. 363, pl. x., fig. 4.

D. 84; A. 71; V. 4. L. lat. 93; L. tr. 30/35. Greatest depth, measured on the lower surface, nearly 3 in the length from the snout to the hypural; head 6.3 in the same. Eye 4.6, posterior dorsal ray 1.7, and caudal fin 1.2 in the head.



Text-fig 4.

PHYLlichTHYS SCLEROLEPIS Macleay. Head $\times 2$.

Scales etenoid above and below, extending onto the fin-rays. Head closely scaly above, without cirri; anterior third of the lower surface closely covered with

large cirri, which are also present on the lower border of the head and on the margin of the gill-opening. Upper eye a little in advance of the lower; interorbital space scaly. Upper anterior nostril in a short thick tube, the posterior in a broad tube directly in front of the eye; lower anterior nostril hidden among the cirri, the posterior in a large tube beneath the upper eye. Teeth forming bands on the left side of each jaw. Mouth opening backward to below the anterior third of the eye; lower lip fringed with a row of short fleshy tentacles. Gill-membranes united posteriorly with the short pectorals, with which they form broad tubular openings.

Dorsal fin commencing well before the eye; its rays increase regularly in length backward, and are bifurcate with their extreme tips free. Anal similar in form to the dorsal. Caudal obtusely pointed. Ventrals subequal, opposite each other, the right united with the left and with the anal. Pectorals rudimentary, the left larger than the right, and composed of about eight rays, of which the longest is shorter than the eye. Lateral line straight from the back of the head to the median caudal rays; on the upper side it curves upward and forward towards the front of the head.

Colour.—Brownish above, indistinctly marked with lighter patches; some of the scales are darker than the others, giving the body a spotted appearance.

Described and figured from a specimen, 168 mm. long, from Port Darwin. I have compared it with the type of the species which is preserved in the Macleay Museum, and find it agrees in all details; the right ventral fin of Macleay's specimen, however, is separate from the anal, the membrane between them having apparently been torn in handling.

PHYLlichthys punctatus, sp. nov.

D. 69-71; A. 61-63; V. 4; C. 13-15. Lateral line 85. Greatest depth, measured on the lower surface, 3.01-3.08 in the length from the snout to the hypural; head 6.03-6.2 in the same. Eye 6.6-7.3, posterior dorsal ray 1.3-1.5, and caudal fin 1.1-1.2 in the head.

Scales ctenoid above and below, extending onto the basal halves of the fin-rays. Head closely scaly above, with a few cirri on the snout; anterior third of the lower surface closely covered with large cirri, which are also present on the lower border of the head and on the margin of the gill-opening. Eyes almost on the same level; interorbital space scaly. Upper anterior nostril in a short, thick tube, the posterior in a broad tube directly before the eye; lower anterior nostril above the upper lip, the posterior in a large tube below the upper margin of the upper eye. Teeth forming bands on the left side of each jaw. Mouth opening backward to below the anterior portion of the eye; lower lip fringed with short tentacles. Gill-membranes expanded posteriorly, and united with the rudimentary pectorals, with which they form tubular openings.

Dorsal fin commencing well in advance of the eye; its rays increase regularly in length backwards, and are bifurcate, with their tips free. Anal of similar form to the dorsal. Caudal rounded or obtusely pointed. Ventrals subequal, almost opposite each other; the right is united with the anal, and more or less completely with the left. Pectorals rudimentary, the left larger than the right, its longest rays about as long as the eye. Lateral line straight from the back of the head to the middle caudal rays; on the upper side it curves upward and forward on the head.

Colour.—Light brown above, with darker blotches; the edge of each scale is darker. Dorsal, caudal, and anal fins with a white margin.

Described from two specimens 205-233 mm. long.

This species is very similar to *P. sclerolepis*, differing only in having smaller eyes, and fewer dorsal and anal rays.

Loc.—Busselton, Geographe Bay, South-Western Australia.

FAMILY ANTENNARIIDÆ.

GENUS RHYCHERUS, Ogilby.

Rhycherus, Ogilby, Proc. Roy. Soc. Qld., xxi., 1907, p. 17 (*R. wildii*, Ogilby).

In his definition of this genus, Ogilby has described the teeth as small, and the tongue as smooth. I regard the teeth as of moderate size, while in his typical specimen of *R. wildii* the tongue has strong teeth on either side of the median line. McCoy placed *R. bifurcatus* in *Chironectes*, and in defining that genus he also described the tongue as smooth, but strong lingual teeth are present in his species.

RHYCHERUS FILAMENTOSUS, Castelnau.

Chironectes filamentosus, Castelnau, Proc. Zool. Soc. Vict., i, 1872, p. 244, and ii., 1873, p. 65.

Antennarius filamentosus, Macleay, Proc. Linn. Soc. N. S. Wales, v., 1881, p. 579.

Chironectes bifurcatus, McCoy, Prodr. Zool. Vict., Dec. 13, 1886, pl. cxxiii. *Id.*, Lucas, Proc. Roy. Soc. Vict., 2nd. ser., ii., 1890, p. 27.

Rhycherus bifurcatus, Ogilby, Proc. Roy. Soc. Qld., xx., 1907, p. 19.

Rhycherus wildii, Ogilby, *loc. cit.*, p. 18.

Four specimens, 70-207 mm. long, show that this species is a little variable in some of its characters, and they indicate that the synonymy quoted above is correct.

One specimen is the type of *R. wildii*, Ogilby, from Southern Australia, for the loan of which I am indebted to Dr. R. Hamlyn-Harris, Director of the Queensland Museum. A second small example was received from the Western Australian Museum for identification, and was collected at Cottesloe Beach, Swan River. A third is 150 mm. long, and was forwarded by Mr. J. A. Kershaw, Director of the National Museum, Melbourne; it was obtained at Brighton, near Melbourne, which is the typical locality of *R. bifurcatus*, McCoy. The fourth is the largest specimen, and comes from South Australia; it was lent me by Mr. Edgar R. Waite, Director of the South Australian Museum.

Castelnau's description of *C. filamentosus* apparently includes several errors, and the details given of the dorsal spines and the dentition are so confused that it is not clear what they are intended to convey. It seems, however, that they may be reconstructed to apply to the typical specimen of *R. wildii*, which is in agreement with the rest of the description, and I am convinced that the two names refer to the same species.

Ogilby's type differs from my other specimens in having the dermal filaments and tubercles of the body and fins more numerous and larger; the flesh is greatly shrunk upon the bones of the head, so that the cranial cavities are more pronounced, and the eyes appear to be placed upon short, broad peduncles as described by Castelnau. The terminal portion of the anterior dorsal spine is differently formed

in three of the specimens: in Ogilby's type it is a crescentic appendage formed of two divergent, fleshy lobes, behind which is a low, broad, petiolate flap; in the small Western Australian specimen, the spine is surmounted by several fleshy tentacles of different lengths, behind which is a skinny sheath which is as long as the rest of the spine; the terminal portion of the Brighton and large South Australian specimens consists of two long branches with two basal flaps as figured by McCoy. I have no doubt that these differences are either individual variations or are due to the different state of preservation of the specimens, and regard all three as referable to the one species.

The small Western Australian specimen is quite similar to the larger Brighton example in its colour-marking, and both only differ from McCoy's figure in having the dorsal fin and an area along its base enclosed in a large, well-defined, white patch; in the largest specimen no such white patch is present, but the dark markings are more extensive and more pronounced than in the figure. Ogilby's specimen has become stained an almost uniform brown after long preservation in spirits.

EXPLANATION OF PLATES.

PLATE VII.

Cypselurus cribrus, Kner. A specimen 232 mm. long from the snout to the middle caudal rays, from off Port Hacking, N. S. Wales.

PLATE VIII.

Fig. 1. *Synaptura cancellata*, sp. nov. Type, 193 mm. long, from near Fremantle, Western Australia.

Fig. 2. *Synaptura fasciata*, Macleay. A specimen 200 mm. long, from off the Richmond River, N. S. Wales.

PLATE IX.

Fig. 1. *Synaptura craticula*, sp. nov. Type, 148 mm. long, from near Bowen, Queensland.

Fig. 2. *Phyllichthys sclerolepis*, Macleay. A specimen 168 mm. long, from Port Darwin, North Australia.

EXPLANATION OF TEXT-FIGURES 1-4.

No. 1.—*Synaptura breviceps* Ogilby. Type, 137 mm. long, from Rockhampton, Queensland. Partially restored.

No. 2.—*Synaptura salinarum* Ogilby. Type, 123 mm. long without the caudal fin, from Kimberley, Queensland.

No. 3.—*Synaptura salinarum* Ogilby. Upper and lower views of head of type.

No. 4.—*Phyllichthys sclerolepis* Macleay. Head of a specimen, 168 mm. long, from Port Darwin, North Australia.

CHECK-LIST OF THE CEPHALOCHORDATES, SELACHIANS, AND FISHES OF QUEENSLAND.

BY J. DOUGLAS OGILBY.

(With Two Text-figures.)

FOR many years check-lists of the fishes of Tasmania,¹ New South Wales,² Victoria,³ and South Australia (in part)⁴ have been in existence,⁵ the while Queensland with, perhaps because of, her magnificent fish-fauna was content to remain unlisted. The present work is designed to remove this reproach from our State.

The model on which it is proposed to fashion the check-list is as follows:—

(1.) *Higher divisions*, from Class to Family; scientific name only or scientific name and general vernacular name.

(2.) *Genus*; earliest scientific name and reference, with such synonym or synonyms as may at any time have been in use among or familiar to Australian authors.

(3.) *Species*; earliest scientific name with author, and vernacular name or names if any; where more than one vernacular name is given, that which is considered preferable is printed in SMALL CAPITALS; references to the earliest author, to Günther's "Catalogue of the Fishes in the British Museum" and Macleay's "Descriptive Catalogue of Australian Fishes"⁶ if included in either, and failing them to the earliest Australian notice; reference to the earliest record for Queensland.

(4.) *Illustration*; reference to the best figure or figures, preference being given to Australian work or, where that is not available, to the best figure in the Queensland Museum Library.

¹ Johnston; Classified Catalogue of the Fishes of Tasmania (Proc. Roy. Soc. Tas., 1882, pp. 53-144) and Complete List of Tasmanian Species (Ibid., 1890, pp. 30-39).

² Ogilby; Catalogue of the Fishes of New South Wales, with their principal synonyms, 1886, pp. 1-67.

Waite; A Synopsis of the Fishes of New South Wales (Mem. N. S. Wales Natur. Club, No. 2, 1904, pp. 1-59).

³ Lucas; A Systematic Census of Indigenous Fish, hitherto recorded from Victorian Waters (Proc. Roy. Soc. Vic.—new ser.—ii, 1890, pp. 15-47).

⁴ Zietz; A Synopsis of the Fishes of South Australia; pt. i, *Leptocardi*, *Cyclostomata*, *Plagiostomi*, and *Holocephali* (Trans. Roy. Soc. S. Austr., xxxii, 1908, pp. 288-293); pt. ii, *Clupeidæ* to *Syngnathidæ* (Ibid., pp. 294-299); pt. iii, *Syngnathidæ* cont. to *Serranidæ*, part (Ibid., xxxiii, 1909, pp. 263-269).

⁵ Even West Australia has a list of sorts (Fraser, Natural History, etc., of Western Australia, 1903, pp. 150-154), but as, among other eccentricities, so well known a fish as the "tailor" appears twice thus—*Pomatomus saltatrix*, Fremantle, p. 151 and *Temnodon saltator*, "Tailor-fish," p. 152—perhaps the less said about it the better.

⁶ Only the catalogue number of the species is given.

(5.) *Dimensions* ; approximately the greatest authenticated dimensions in length, width (in certain rays), and weight.

(6.) *Uses* ; if any.

(7.) *Range* ; within the boundaries of the State, except in certain noteworthy instances, as it is considered that the extralimital distribution is beyond the scope of this work.

In practice individual modifications of this scheme have of necessity been made occasionally, but these have been introduced as seldom as is consistent with the general trend of the work.

Finally the reception of Garman's "Plagiostomia," during the current May,⁷ necessitated the addition of references to that work, imperfect though it be.

For the purpose of facilitating information regarding the geographical distribution of our fishes I propose to divide Queensland into three zoological districts, as follow :—

South Queensland (S.Q.).—

Embracing all the coastline between the mouth of the Tweed River, our natural boundary, and the Tropic of Capricorn, the islands and reefs outlying therefrom and the hinterland to the South Australian and Northern Territory marches, with Moreton, Hervey, and Wide Bays, and Port Curtis as its principal inlets.

Middle Queensland (M.Q.).—

Extending in similar fashion from the tropic to 20° S. lat., with Keppel and Shoalwater Bays, Broad Sound, Repulse and Edgecumbe Bays. And

North Queensland (N.Q.).—

Comprising York Peninsula and the Gulf of Carpentaria, with their respective islands, reefs, rivers, and hinterlands.

The following abbreviations will be employed throughout this work :—

A.M., Australian Museum ; B.N.G., British New Guinea ; B.R., Barrier Reef ; D.N.G., Dutch New Guinea ; M.Q., Middle Queensland ; N.Q., North Queensland ; N.S.W., New South Wales ; N.T., Northern Territory ; O.C., Old Collection of Q.M., Queensland Museum ; S.A., South Australia ; S.Q., South Queensland ; Tas., Tasmania ; T.S., Torres Strait ; Vic., Victoria ; W.A., West Australia.

Class I—PROTOCHORDATA.

Order I—CEPHALOCHORDATA.

Family I—BRANCHIOSTOMATIDÆ. "THE LANCELETS."

Genus 1—**BRANCHIOSTOMA** Costa, Cenni Zool. Napol., 1834, p. 49 (*lubricum lanceolatum*). Syn.—*Amphioxus* Yarrell 1836 ; *Dolichorhynchus* Willey 1901.

⁷ The part dealing with the selachians was written during the winter of 1914, but was crowded out of that year's "Memoirs" from want of space.

1. *belcheri* Gray.

Proc. Zool. Soc. London, 1847, p. 35 : Lundu River, Borneo (as *Amphioxus belcheri*)—Günther, Voy. Alert, Zool., p. 32.

Figure :—Kirkaldy, Quart. Journ. Micr. Sci., xxxvii, p. 313, pl. 35, fig. 8.

Dimensions :—To about 50 millim.

Range :—Prince of Wales Island, T.S.

Genus 2—**EPIGONICHTHYS** Peters, Mon. Akad. Berlin, 1876, p. 325 (*cultellus*).
Syn.—*Paramphioxus* Haeckel 1893 ; *Heteropleuron* Kirkaldy 1895.

2. *cultellus* Peters.

Ibid. : Moreton Bay, S.Q.—Günther, ibid. (as *Branchiostoma cultellum*).

Figure :—Kirkaldy, ibid., p. 316, pl. 34, fig. 2 (as *Heteropleuron cultellum*).

Dimensions :—To about 55 millim.

Range :—Coast of Queensland from south to north ; Islands of Torres Strait.

3. *hedleyi* Haswell.

Rec. Austr. Mus., vii, pt. 1, 9 March 1908, p. 33 (as *Heteropleuron hedleyi*).

Figure :—Haswell, ibid., text-fig. 1.

Dimensions :—Of type 28 millim.

Range :—Murray Island.

Genus 3—**ASYMMETRON** Andrews, Stud. Biol. Lab. John Hopkins Univ., v, 1893, p. 237 (*lucayanum*).

4. *caudatum* Willey.

Quart. Journ. Micr. Sci., xxxix, 1896, p. 219 : Louisiade Archipelago—Haswell, ibid. (as *Heteropleuron-Asymmetron-lucayanum*).

Figure :—Willey, ibid., pl. 13.

Dimensions :—Of type 29.5 millim.

Range :—Murray Island.

Note :—I think it advisable to follow Herdman (Cambridge Nat. Hist., vii, p. 137) in keeping the eastern and western forms of *Asymmetron* separate, until more is known about them, especially the latter.

Key to the Genera.

- a*¹ Preoral tentacles forming a continuous series ; infraoral fold continuous with the right metapleur only.
- b*¹. Gonad pouches developed on both epipleurs 1. **BRANCHIOSTOMA**.
- b*². Gonad pouches developed on the right epipleur only 2. **EPIGONICHTHYS**.
- a*². Preoral tentacles not continuous ; infraoral folds continuous with both metapleura ; gonad pouches developed on the right epipleur only 3. **ASYMMETRON**.

Keys to the Australian Species.

1. **BRANCHIOSTOMA** :—
- a*¹. Myotomes 63 to 65 ; gonad pouches 21 to 29 1. *belcheri*.
2. **EPIGONICHTHYS** :—
- a*¹. A notch between the rostral and dorsal folds.
- b*¹. Myotomes 70 to 78 ; gonad pouches 26 to 31 2. *bassanus*.
- b*². Myotomes 55 ; gonad pouches 17 to 22 3. *australis*.
- a*². No notch between the rostral and dorsal folds ; myotomes 50 to 56 ; gonad pouches 17 to 20.
- c*¹. Preoral cirri 41 to 43 ; dorsal fold high 4. *cultellus*.
- c*². Preoral cirri 25 to 30 ; dorsal fold low 5. *hedleyi*.
3. **ASYMMETRON** :—
- a*¹. Myotomes 60 6. *caudatum*.

Class II—MARSIPOBRANCHII.

THE LAMPREYS & HAGFISHES.

Not represented in Queensland waters.

Class III—SELACHII.

Subclass A—TREMATOPNEA.

Order I—EUSELACHII. "The Sharks and Rays."³Suborder *a*—PLEUROTREMATA. "The Sharks."

Division A—GALEOIDEI.

Family I—CARCHARIIDÆ. "THE NURSE SHARKS."

Genus 1—**CARCHARIAS** Rafinesque, Caratt. alc. nuov. Gen., 1810, p. 10 (*taurus*). Syn.—*Triglochia* Müller & Henle, 1837; *Odontaspis*, Agassiz, 1838.⁹

1. *arenarius* Ogilby. "GRAY NURSE." Sand Shark.

Ann. Queensl. Mus., No. 10, 1 Nov. 1911, p. 37: Moreton Bay, S.Q.—Günther, Catal., viii, p. 392, part.; Macleay, Catal., 1084 part (as *Odontaspis americanus*).

Figure :—McCoy, Prodr., pl. 64, fig. 1 (as *O. taurus*).

Dimensions :—To at least 3.66 mm.

Range :—Coast of South Queensland, rare. Moreton Bay (*Ogilby*).

Type :—In the Queensland Museum. Reg. No. I. 14/1884.

³ From an economic point of view sharks and rays have been altogether neglected by our fishermen, nevertheless we find in them several products which might be turned to good account commercially. For instance shark fins are in general use throughout the Chinese Empire for thickening soups, etc., and I know of no reason to prevent the building up of a lucrative trade in this commodity between the two countries; an excellent isinglass is also obtainable from these fins. Again all selachians yield a large quantity of oil, which is of such proved commercial value that the capture of sharks for this purpose alone provides employment for scores of families on the ocean coasts of Europe, even though the species sought for is small, and the fishery is prosecuted by means of hand-lines worked at a depth of 200 fathoms and over. On the Pacific Coast of North America *Galeus zyopterus*, the eastern representative of our "school shark," is popularly known as the "oil-shark," because of the amount of that product which may be extracted from its liver, and there is little reason to doubt that our Australian species might be as lucratively utilized; in fact the industry was at one time in existence in Tasmania (Johnston, Proc. Roy. Soc. Tas., 1882, p. 94). In the selachians the liver is very large, that of a "tiger shark" (*Galeocerdo arcticus*) measuring 13 feet, no uncommon size, weighing no less than 275 lb. Furthermore the skin of many of the smaller sharks and rays furnishes an unrivalled shagreen, which is extensively used in the polishing of wood and marble. From their great durability and the handsome markings of many of the species, such as the "wobbeongs" (*Orectolobus spp.*), these skins would form an excellent substitute for leather, alligator skin, and the like, in the manufacture of purses, reticules, etc. They might also be advantageously employed for coating the handles of articles on which a firm hold is vitally necessary, such as the grip of a sword. For these and like purposes they would doubtless command a ready sale, while the tanned skins of the larger species should also be of marketable value. Sharks' teeth too make up into handsome brooches, scarf-pins, and similar ornaments. Doubtless other selachian remains might be made economically useful, as fertilizers for instance. In addition to these by-products the flesh of many of the smaller sharks (*Scyliorhinidae* and some *Orectolobidae*) and rays (*Rhinobatidae*, *Rajidae*, and *Dasybatidae*) is excellent, and is largely used by the inhabitants of many seaward countries. I can speak from personal experience of the good qualities of a shark (*Scyliorhinus canicula*) and three rays (*Raja clavata*, *R. batis*, and *Urolophus testaceus*). Enough, however, has been written to show that these creatures are not so worthless as many suppose.

⁹ See Ogilby, Ann. Queensl. Mus., No. 10, p. 38.

Family II—ALOPHIIDÆ. "THE FOX SHARKS."

Genus 2—**ALOPIAS** Rafinesque, Caratt. alc. nuov. Gen., 1810, p. 12 (*macrourus* = *vulpinus*). Syn.—*Alopecias* Müller & Henle 1837; *Vulpecula* Garman 1913.

2. **vulpinus** Bonnaterre. "THRESHER." Fox Shark. Long-tailed Shark.

Encycl. Méth., Ichth., 1788, p. 9: "La Méditerranée" (as *Squalus vulpinus*)
—Günther, Catal., viii, p. 393; Macleay, Catal., 1085 (as *Alopecias vulpes*)—Garman, Plagiost., p. 30 (as *Vulpecula marina*).

Figures:—McCoy, Prodr., pl. 88 (as *Alopecias vulpes*)—Garman, *ibid.*, pl. 7,

fig. 1.

Dimensions:—To at least 4.5 mm.

Range:—Coast of South Queensland.¹⁰

Family III—ISURIDÆ. THE "PORBEAGLES" or Mackerel Sharks.

Subfamily a—ISURINÆ.

Genus 3—**ISURUS** Rafinesque, Caratt. alc. nuov. Gen., 1810, p. 12 (*oxyrhynchus*). Syn.—*Oxyrhina* Müller & Henle 1837; *Isuropsis* Gill 1861.

3. **glaucus** Muller & Henle. "BLUE POINTER."

Plagiost., 1841, p. 69 (as *Oxyrhina glauca*)—Günther, Catal., viii, p. 391;
Macleay, Catal., 1082 (as *Lamna glauca*)—Garman, Plagiost., p. 38.

Figure:—Müller & Henle, *ibid.*, pl. 29.

Dimensions:—To at least 3.66 mm.

Range:—Coast of South Queensland, rare.¹¹

Subfamily b—CARCHARODONTINÆ.

Genus 4—**CARCHARODON** Müller & Henle, Charlesworth Mag. Nat. Hist., ii, 1838, p. 37 (*rondeletii* = *carcharias*).

4. **carcharias** Linnæus. "WHITE POINTER." Great White Shark; Maneater.

Syst. Nat., ed. 10, i, 1758, p. 235: "in Europa" (as *Squalus carcharias*)—
Günther, Catal., viii, p. 392; Macleay, Catal., 1083 (as *C. rondeletii*)—
Garman, Plagiost., p. 32.

Figures:—McCoy, Prodr., pl. 74 (as *C. rondeletii*)—Garman, *ibid.*, pl. v, fig. 1.

Dimensions:—Normally to between 3 and 4 mm. Occasionally, however, examples of much larger size are recorded, such, for instance, as one noticed by Günther¹² as having been caught many years ago at Port Fairy, Victoria, the jaws of which are now in the British Museum, and which had attained the enormous length of over 10 mm. (36.5 feet). "Forty feet and more" (Garman).

¹⁰ The species has not, so far as I am aware, ever been captured in Queensland waters, but it has been seen so often at close quarters as to preclude its omission from this list. Only a short time ago Messrs. Welsby and Appel, both gentlemen of wide experience, had a most interesting view of a combat in Moreton Bay between a pair of these sharks and a whale, the object of the attack being a very young calf which was accompanying the latter. So intent were the marauders on their nefarious design that they allowed the steamer to steal up within its own length of them before they sheered off into deeper water, thus permitting all on board to obtain a full and close view of both sharks and whales. On the occasion of the visit of the ill-fated "Endeavour" to this State during the winter of 1910 these sharks were seen on several occasions. I take this opportunity of recording my appreciation of the scientific value of the work done by that vessel, and my profound regret at the sad disaster which has befallen her officers and crew.

¹¹ This species is included on the evidence of a pair of jaws taken from a "small blue shark," caught at Bulwer, Moreton Bay. I know of no other Australian shark to which the jaws could belong, as the absence of denticles debars *Carcharias*.

¹² Study of Fishes, p. 321, text-fig. 114 (a tooth).

Range :—Coast of South Queensland, rare.¹³

Family IV—**ORECTOLOBIDÆ**. “THE CARPET SHARKS.”

Subfamily *a*—**GINGLYMOSTOMATINÆ**.

Genus 5—**NEBRIUS** Rüppell, Neue Wirbelth. Abyss., Fisch., 1840, p. 62 (*concolor*). Syn.—*Nebrodes* Garman 1913.

5. **concolor** Rüppell. “TAWNY SHARK.”

Ibid.: Red Sea—Günther, Catal., viii, p. 409; Regan, Proc. Zool. Soc., 1908, ii, p. 352 (as *Ginglymostoma concolor*)—Garman, Plagiost., p. 57 (as *Nebrodes concolor*).

Figure :—Garman, *ibid.*, pl. 8, fig. 7 (as *Nebrodes macrurus*).

Dimensions :—No data as to the adult, but evidently grows to a large size, as a young male from the Solomon Group, in the Australian Museum, Sydney, though measuring 1.4 mm., has the claspers but little developed.

Range :—Darnley Island (*Tosh. Coll.*).

Subfamily *b*—**ORECTOLOBINÆ**.

Genus 6—**ORECTOLOBUS** Bonaparte, Icon. Faun. Ital., Pesc., 1834, fasc. 7 (*barbatus* = *maculatus*). Syn.—*Crossorhinus* Müller & Henle 1837; *Eucrossorhinus* Regan 1908.

6. **ogilbyi** Regan. “TASSELED WOBEGONG.”

Ann. & Mag. Nat. Hist. (8) iii, Dec. 1909, p. 529: Torres Strait—Ogilby & McCulloch, Proc. Roy. Soc. N.S.Wales, xlii, 1909, p. 272 (as *O. dasypogon*).

Figure :—Ogilby & McCulloch, *ibid.*, pl. 43, fig. 1.

Dimensions :—To at least 120 cm.

Range :—Coast of North Queensland. Dunk Island (*Ogilby*). Thursday Island (*Kent*). Torres Strait (*Macleay*).

7. **maculatus** Bonnaterre. “OCCELLATED WOBEGONG.” Carpet Shark.

Encycl. Méth., Ichth., 1788, p. 8: “La mer du sud” (as *Squalus maculatus*)—Regan, Proc. Zool. Soc., 1908, p. 355 (as *O. barbatus*)—Garman, Plagiost., p. 52.

Figure :—Ogilby & McCulloch, *ibid.*, pl. 42, fig. 2.

Dimensions :—To at least 110 cm.

Range :—Coast of South Queensland. Moreton Bay (*Ogilby*).¹⁴

8. **devisi** Ogilby. “BANDED WOBEGONG.” Carpet Shark. Tiger Shark.

Mem. Queensl. Mus., v, 1916, p. 152—de Vis, Proc. Linn. Soc. N.S.Wales, viii, pt. 2, 17 July 1883, p. 289: Moreton Bay, S.Q. (as *Crossorhinus ornatus*)—Regan, *ibid.*, p. 289; Garman, Plagiost., p. 49.

Figure :—Ogilby & McCulloch, *ibid.*, pl. 42, fig. 1.

Dimensions :—To at least 200 cm. Said to grow much larger.

Range :—Coast of Queensland, presumably from south to north.

Type :—In the Queensland Museum; Reg. No. I. 11/164.

¹³ I include this unmistakable species on the strength of a fine specimen, from Moreton Bay, exhibited in the Fisheries Court of the Brisbane National Association's Show of 1909. This is the only authentic occurrence of which I can find any record.

¹⁴ Owing to the previous confusion between this species and the succeeding, the exact northern range of *O. maculatus* can not be definitely fixed, but it is much the rarer of the two in Moreton Bay.

9. *tentaculatus* Peters. "SOMBER WOBEGONG."

Mon. Akad. Berlin, 1864, p. 123: Port Adelaide, S.A.; Günther, Catal., viii, p. 414; Macleay, Catal., 1096 (as *Crossorhinus tentaculatus*)—Ogilby & McCulloch, *ibid.*, p. 278; Garman, Plagiost., p. 51.

Figure :—Regan, *ibid.*, pl. xii, fig. 3.

Dimensions :—To at least 90 cm.

Range :—Coast of North Queensland. Cape York (Günther).¹⁵

Genus 7—**BRACHÆLURUS** Ogilby, Proc. Roy. Soc. Queensl., xx, 30 Sept. 1907, p. 27 (*modestus*). Syn.—*Cirriscyllium* Ogilby 1908.

10. *modestus* Günther. "BLIND SHARK."

Proc. Zool. Soc., 1871, p. 654; Macleay, Catal., 1093 (as *Chiloscyllium modestum*)—Macleay, *ibid.*, 1094 (as *C. furvum*)—Regan, *ibid.*, p. 354; Ogilby & McCulloch, *ibid.*, p. 281.

Figures :—Günther, *ibid.*, pl. 54; Waite, Rec. Austr. Mus., iv, pl. 4, fig. 1 (*fetus*) (as *Hemisicyllium modestum*).

Dimensions :—To at least 90 cm.

Range :—Coast of South Queensland.

Genus 8—**HETEROSCYLLIUM** Regan, Ann. & Mag. Nat. Hist. (8) ii, Nov., 1908, p. 455 (*colcloughi*). Syn.—*Brachælurus* Ogilby 1908, by an oversight.

11. *colcloughi*. "BLUE-GRAY SHARK."

Proc. Roy. Soc. Queensl., xxi, 25 Aug. 1908, p. 4: Moreton Bay (as *Brachælurus colcloughi*)—Ogilby & McCulloch, *ibid.*, p. 284.

Unfigured.

Dimensions :—Of type, a young male, 457 millim.

Range :—Coast of South Queensland. Moreton Bay (Ogilby & Q.M., O.C.).

Type :—Accidentally destroyed.

Genus 9—**CHILOSCYLLIUM** Müller & Henle, Arch. f. Nat., 1837, i, p. 395 (*plagiosum*). Syn.—*Hemisicyllium* Müller & Henle 1838.

12. *ocellatum* Bonnaterre. "EPAULETTE SHARK."

Encycl. Méth., Ichth., 1788, p. 8; "La mer du sud" (as *Squalus ocellatus*)—Günther, Catal., viii, p. 410; Macleay, Catal., 1091; Regan, *ibid.*, p. 398; Ogilby & McCulloch, *ibid.*, p. 290—Garman, Plagiost., p. 44 (as *Hemisicyllium ocellatum*).

Figure :—Shaw, Nat. Misc., pl. 161.

Dimensions :—To at least 90 cm.

Range :—Coasts of Middle and North Queensland, common about coral reefs. Masthead Island (McCulloch). Nor-West Islet (*Endeavour Coll.*). Dunk Island and

¹⁵ McCulloch, under date 9-v-14, writes: "I do not believe that the Cape York and the South Australian specimens belong to the same species, though as I have no decent specimens of either I am not in a position to prove my point." With this opinion I am inclined to agree. We know that *O. tentaculatus* occurs on the coast of South Australia, because not only did Peters' type come from Port Adelaide, but the Australian Museum possesses a specimen from the same place (v. Ogilby, Proc. Linn. Soc. N. S. Wales, xiv, p. 182). But there is an alternative proposition in the possibility of the label on Herr Dämel's examples, on the authority of which alone the Queensland locality rests, having been accidentally changed. If both the records are correct it is exceedingly strange that the species has never been recorded from any intermediate station on either coast of Australia. Under the circumstances, however, I do not see my way clear to erase the name from our list, even though its reputed habitat has been fairly well exploited without yielding further evidence in favour. In face of these facts Garman omits all mention of the authenticated South Australian locality and gives the distribution of the species as "Queensland" only.

Green Island, Cairns (*Ogilby*). Hope and Murray Islands (*McCulloch*). Cape York and Torres Strait (*Macleay*).

13. **trispiculare** Richardson. "SPECKLED SHARK."

Icon. Pisc., 1843, p. 5: Turtle Island; Garman, *Plagiost.*, p. 45 (as *Hemiscyllium trispiculare*)—Günther, *Catal.*, viii, p. 411; Macleay, *Catal.*, 1092; Regan, *ibid.*, p. 359; Ogilby & McCulloch, *ibid.*, p. 293.

Figure:—Richardson, *Zool. Erebus & Terror, Ichth.*, pl. 28.

Dimensions:—No data; type, a male of 560 millim.

Range:—Coast of North Queensland. Turtle Island, Gulf of Carpentaria (*Richardson*)¹⁶; Cape York (*Günther*).¹⁷

14. **punctatum** Müller & Henle. "BROWN-BANDED SHARK."

Plagiost., 1841, p. 18: Java; Günther, *Catal.*, viii, p. 413; Regan, *ibid.*, p. 360; Garman, *Plagiost.*, p. 61.

Figures:—Müller & Henle, *ibid.*, pl. 3; Ogilby & McCulloch, *ibid.*, text-fig. 1, p. 289 (*egg-case*) and pl. 43, fig. 2 (*fetus*).

Dimensions:—No reliable data as to adult. Garman alludes to a male of 660 millim. in which the claspers "are very small and immature," and naturally concludes, as indeed Ogilby & McCulloch had previously suggested, that "this is probably a species of which individuals reach a considerable size." As regards our South Queensland species it must however, be admitted that this supposition is somewhat discounted by the small size of the egg-case, which rarely exceeds 100 millim. in length by 52 in. breadth. It is possible that we may be confounding two species, of which the Malayan form may attain a much greater size than this Moreton Bay shark, which we know only from its egg-case and fetus, and of which the adult so tantalizingly eludes our search.

Range:—Coast of Queensland from south to north. Moreton Bay and Dunk Island (*Ogilby & McCulloch*), the latter on the evidence of empty egg-cases only, as also Hervey Bay (*Endeavour Coll.*). Thursday Island (*Regan*).

Genus 10—**STEGOSTOMA** Müller & Henle, *Arch. f. Nat.*, 1837, i, p. 395 (*fasciatum* = *tygrinum*).

15. **tygrinum** Bonnaterre. "ZEBRA SHARK."

Encycl. Méth., *Ichth.*, 1788, p. 8: "La mer des Indes" (as *Squalus tygrinus*)—Günther, *Catal.*, viii, p. 409; Regan, *ibid.*, p. 364 (as *Stegostoma tigrinum*)—Ogilby & McCulloch, *ibid.*, p. 295; Ogilby, *Mem. Queensl. Mus.*, iii, Garman, *Plagiost.*, p. 59 (as *S. varium*).

Figure:—Day, *Fish. India*, pl. 187, fig. 4.

Dimensions:—To at least 3.6 mm.

Range:—Coast of Queensland presumably from south to north.¹⁸ Cape Bowling Green (*Hamlyn Harris Coll.*). Dunk Island (*Ogilby*). Little Mulgrave River (*McCulloch*). Cape York and Normanton (*Ogilby*).

Family VI—SCYLIORHINIDÆ. "THE CAT SHARKS."

Genus 11—**HALÆLURUS** Gill, *Ann. Lyc. Nat. Hist. New York*, vii, 1861, p. 407 (*bürgeri*).

16. **labiosus** Waite. "BLACK-SPOTTED CAT SHARK."

Rec. Austr. Mus., vi, pt. 2, 15 Sept. 1905, p. 57: Freemantle, W.A. (as *Catulus labiosus*)—Günther, *Catal.*, viii, p. 401; Macleay, *Catal.*, 1087 (as *Scyllium maculatum*)—Garman, *Plagiost.*, p. 88.

¹⁶ See Ogilby, *Mem. Queensl. Mus.*, iii, p.

¹⁷ *Ann. & Mag. Nat. Hist.* (3) xx, p. 67.

¹⁸ Though all our Queensland records come from the northern division of the State, it occurs as far south as Port Jackson.

Figure :—Waite, *ibid.*, text-fig. 23 (*under surface of head*).

Dimensions :—To at least 620 millim.

Range :—North Coast of Queensland. Bramble Cay, N.Q. (*Brit. Mus.*). There is a scyliorhinoid egg-case in the State Museum collected at Cape York by Mr. Kendal Broadbent, which probably belongs to this species.

Family VI—GALEIDÆ.

Subfamily *a*—MUSTELINÆ. "THE HOUNDS."

Genus 12—**MUSTELUS** Linck, *Mag. neue Phys. u. Nat.* vi, 1790, p. 31 (*mustelus*).

Syn.—*Pleuracromylon* Gill 1864 (species with placenta); *Cynias* Gill 1903 (species without placenta).

17. **antarcticus** Günther. "GUMMY." Smooth Hound.

Catal., viii, p. 387: New South Wales, etc.; Macleay, Catal. 1081; Waite, *Rec. Canterb. Mus.*, i, p. 140—Garman, *Plagiost.*, p. 175 (as *Galeorhinus antarcticus*).

Figures :—Waite, *Rec. Austr. Mus.*, iv, text-fig. 19, p. 177 (*fetus*) (as *Galeus antarcticus*)—McCulloch, *Rec. Austr. Mus.*, vii, pl. 90, fig. 3 (*adult*).

Dimensions :—To at least 105 cm.

Range :—Coasts and estuaries of South Queensland, not uncommon. Southport, Moreton Bay, Brisbane River, Great Sandy Strait (*Ogilby*). Point Lookout in 31 fath. (*Endeavour Coll.*).

Subfamily *b*—GALEINÆ. "THE TOPES."

Genus 13—**GALEUS** Rafinesque, *Caratt. alc. nuov. Gen.*, 1810, p. 13 (*galeus*; type by suggestion). Syn.—*Galeorhinus* Blainville 1816.

18. **australis** Macleay.¹⁹ "SCHOOL SHARK." Tope.

Proc. Linn. Soc. N. S. Wales, vi, pt. 2, 12 Sept. 1881, p. 354: Port Jackson, N.S.W.; *id.*, Catal., 1079; Waite, *Rec. Canterb. Mus.*, i, p. 139; *Ogilby*, *Proc. Roy. Soc. Queensl.*, xxi, p. 23.

Figure :—McCoy, *Prodr.*, pl. 64, fig. 2.

Dimensions :—To at least 180 cm.

Range :—Coast of South Queensland, rare. Moreton Bay (*Ogilby*).

Genus 14—**GALEOCERDO** Müller & Henle, *Arch. f. Nat.*, 1837, i, p. 398 (*arcticus*).

19. **arcticus** Faber. "TIGER SHARK."

Naturg. Fisch. Islands, 1829, p. 17: Iceland (as *Squalus arcticus*)—Günther, Catal., viii, p. 377; Garman, *Plagiost.*, p. 148—Günther, *ibid.*; Macleay, Catal., 1078 (as *G. rayneri*).

Figures :—Müller & Henle, *Plagiost.*, pl. 24—McDonald & Barron, *Proc. Zool. Soc.*, 1868, pl. 32.

Dimensions :—To at least 4.5 mm.

¹⁹ Very closely allied to, if not identical with, *G. galeus*.

Range :—Coasts and estuaries of Queensland from south to north, common.²⁰

Subfamily *c*—CARCHARHININÆ. "THE BLUE SHARKS."

Genus 15—**PHYSODON** Müller & Henle, Plagiost., 1841, p. 30 (*mülleri*).

20. *mülleri* Müller & Henle.

Ibid. : Bengal ; Günther, Catal., viii, p. 360 ; Macleay, Catal., 1072 (as *Carcharias mülleri*)—Garman, Plagiost., p. 108.

Figure :—Müller & Henle, *ibid.*, pl. xix, fig. 1 (*dentition*).

Dimensions :—No data.

Range :—Coast of North Queensland. Cape York (*Macleay*). Specimen in the University Museum, Sydney.

21. *taylori* Ogilby.

Mem. Queensl. Mus., iii, 1915, p. 117 : Townsville.

Unfigured.

Dimensions :—Of type 657 millim.

Range :—Coast of North Queensland.

Type :—In the Queensland Museum. Reg. No. I. 12/738.

Genus 16—**SCOLIODON** Müller & Henle, Arch. f. Nat., 1837, i, p. 397 (*laticaudus*).

22. *jordani* Ogilby.

Proc. Roy. Soc. Queensl., xxi, 1909, p. 88 (adv. copy 25 Aug. 1908) : Caloundra.

Unfinished.

Dimensions :—Of type 850 millim.

Range :—Coast of South Queensland.

Type :—Accidentally destroyed.

23. *affinis* Ogilby.

Mem. Queensl. Mus., i, 27 Nov. 1912, p. 29 ; Noosa Head.

Unfigured.

Dimensions :—Of type 526 millim.

Range :—Coast of South Queensland.

Type :—In the Queensland Museum, by favour of the Amateur Fishermen's Association of Queensland. Reg. No. I. 13/1526.

²⁰ The most cunning and dangerous of all our sharks, lurking about wharves and similar places, where they pick up an easy living through the refuse thrown overboard from the vessels alongside, together with an occasional dog or other animal. When on board the "Endeavour" we were witnesses to a remarkable instance of gluttony and its fitting reward. While a brace of snapper was being hauled up a large shark of this species was observed to be accompanying them from the bottom ; instead, however, of tearing them from the hook, as is the usual practice in such cases, it contented itself with merely nosing them about, not even making any more vigorous protest when they were finally lifted intact out of the water. As it persisted in continuing this form of amusement with other captures, we threw out a shark hook nicely baited with fat pork, which it soon found. Even this tempting morsel it only nosed and mumbled for several minutes before taking it into its mouth so far as to enable us to effect its capture. When opened the secret of its extraordinary behaviour was revealed, for it was found to be full actually to the gullet with large leather-jackets (*Cantherines ayraudi*), of which it had already swallowed no less than 32, averaging fully fifteen inches apiece, all of which were perfectly fresh, unbitten, and undigested. This shark measured over 13 feet.

24. **acutus** Rüppell.

Neue Wirbelth. Abyss., Fisch., 1837, p. 65: Red Sea; Günther, Catal., viii, p. 358; Ogilby, Proc. Linn. Soc. N. S. Wales, xiii, p. 1766 (as *Carcharias acutus*)—Garman, plagiostr. p. 111 (as *S. palasorrah*).

Figure:—Day, Fish. India, pl. 188, fig. 2.

Dimensions:—To at least 750 millim. Said to attain a considerable size (*Day*).

Range:—Coast of Queensland, south to the Burnett River Heads, S.Q. (*Ogilby*).

Specimen in the Australian Museum, Sydney.

25. **longmani** Ogilby.

Mem. Queensl. Mus., i, 27 Nov. 1912, p. 30: Moreton Bay, S.Q.

Unfigured.

Dimensions:—Of type 526 millim.

Range:—Coast of S. Queensland.

Type:—In the Queensland Museum. Reg. No. I. 12/292.

Genus 17—**Aprionodon** Gill, Ann. Lyc. Nat. Hist. New York, vii, 1861, p. 411 (*punctatus*=*isodon*). Syn.—*Aprion* Müller & Henle 1841; not of Cuvier & Valenciennes 1830.

26. **acutidens** Rüppell.

Neue Wirbelth. Abyss., Fisch., 1837, p. 65; Günther, Catal., viii, p. 361; Macleay, Catal., 1071 (as *Carcharias acutidens*)—Garman, Plagiost., p. 118.

Figure:—Rüppell, *ibid.*, pl. 18, fig. 3.

Dimensions:—To at least 183 cm. (*Day*).

Range:—Coast of North Queensland. Torres Strait (*Macleay*). Specimen in the University Museum, Sydney.

Genus 18—**RHIZOPRION** Ogilby, Mem. Queensl. Mus., iii, 1915, p. 132 (*crenidens*).

27. **crenidens** Klunzinger.

Sitz. Akad. Wien, lxxx, 1879, i, p. 426: Coast of Queensland; Macleay, Catal., 1284 (as *Carcharias crenidens*).

Figure:—Klunzinger, *ibid.*, pl. 8, fig. 3 (*dentition*).

Dimensions:—To at least 850 millim.

Range:—Coast of South Queensland. Moreton Bay (*Ogilby*). Cape Moreton, 73 fath.; Double Island Point, 33 fath., 29 spec.; Rocky Island Reef (*Endeavour Coll.*).²¹

Genus 19—**CARCHARHINUS** Blainville, Bull. Soc. Philom., 1816, p. 121 (*commersonii*). Syn.—*Carcharias* Cuvier 1817, not of Rafinesque 1810 (q.v., p. 73).

28. **stevensi** Ogilby.

Ann. Queensl. Mus., No. 10, 1 Nov. 1911, p. 38: Bustard Bay.

Unfigured.

Dimensions:—To about 2 mm.

Range:—Coasts of South and Middle Queensland. Bustard Bay, S.Q. and Nor-West Islet, M.Q. (*Ogilby*).²²

²¹ This is the most common of the smaller galeids on our southern coast, and has the right to inclusion in the New South Wales fauna, the "Endeavour" having trawled a specimen off Cape Byron.

²² In the original description the lengths of the specimens examined are given as 164 and 187 millim. This should read "cm."

29. **amblyrhynchos** Bleeker.

Nat. Tijds. Nederl. Ind., x, 1856, p. 467 (as *Carcharias-Prionodon-amblyrhynchos*.)

Unfigured.

Dimensions :—No data.

Range :—Coast of North Queensland. Cape Bowling Green (*Ogilby*).

30. **melanopterus** Quoy & Gaimard.

Voy. Uranie, Zool., 1824, p. 194 : Waigiou ; Günther, Catal., viii, p. 369 ; Macleay, Catal., 1077 ; *Ogilby*, Proc. Roy. Soc. Queensl., xxi, p. 88 (as *Carcharias melanopterus*)—Garman, Plagiost., p. 134.

Figure :—Jordan & Evermann, Bull. U.S. Fisher. Comm., xxiii, pl. 1.

Dimensions :—To at least 3.66 mm.

Range :—Coast of Queensland from south to north. Snapper Banks off Moreton Bay, S.Q. (*Ogilby*). Nor-West Islet, M.Q. (*Endeavour Coll.*). Darnley Island (*Tosh Coll.*).

31. **spenceri** *Ogilby*. "ESTUARY SHARK."

Proc. Roy. Soc. Queensl., xxiii, 1911, p. 3 (adv. cop. 7 Nov. 1910) : Brisbane River.

Unfigured.

Dimensions :—To at least 2.2 mm.

Range :—Coasts and estuaries of South and Middle Queensland. Moreton Bay, Brisbane River, and Great Sandy Strait, S.Q. (*Ogilby*). Old Woman Island and Hervey Bay, S.Q., and Rocky Island Reef, M.Q. (*Endeavour Coll.*).²³

Subfamily *d*—CESTRACIONINÆ. "THE HAMMER-HEADED SHARKS."

Genus 20—**CESTRACION** Walbaum, Artedi Genera, 1792, p. 580 (*zygæna*). Syn.—*Sphyrna* Rafinesque 1810 ; *Zygæna* Cuvier 1817.

Subgenus *α*—EUSPHYRA Gill, Ann. Lyc. Nat. Hist. New York, vii, 1861, p. 412 (*blochii*).

32. **blochii** Cuvier.

Règne Anim., ii, 1817, p. 127 : Indian Seas ; Günther, Catal., viii, p. 380 (as *Zygæna blochii*)—*Ogilby*, Ann. Queensl. Mus., No. 9, p. 4 (as *Sphyrna blochii*)—Garman, Plagiost., p. 156.

Figure :—Day, Fish. India, pl. 184, fig. 4.

Dimensions :—To at least 150 cm. ; "attains to a very large size." (*Day*, from the reports of fishermen).

Range :—Coast of North Queensland. Rockingham Bay (*Ogilby*).

Subgenus *β*—CESTRACION Walbaum, *v. sup.*

33. **lewini** Lord. "AUSTRALIAN HAMMERHEAD."

In Griffith's Anim. Kingd., x, 1834, p. 640 (as *Zygæna lewini*)—Waite, Mem. Austr. Mus., iv, 1899, p. 34 (as *Sphyrna lewini*).

Figure :—McCoy, Prodr., pl. 56, fig. 1 (as *Zygæna malleus*).

Dimensions :—To at least 3.66 millim.

Range :—Coast of South Queensland. Moreton Bay (*Q.M.*).

²³ This is the common estuary shark of our rivers, and has been known to follow shoals of fishes well beyond the tideway. A specimen 159 cm. long contained 8 fetus, each of which measured from 43 to 47 cm., or an average of two sevenths of the total length of the mother.

Subgenus γ —**PLATYSQUALUS** Swainson, Classif. Fish., ii, 1839, p. 318 (*tudes*).

34. **tudes** (Cuvier MS).

Valenciennes, Mém. Mus. Hist. Nat., ix, 1822, p. 225; Günther, Catal., viii, p. 332 (as *Zygæna tudes*)—Ogilby, Ann. Queensl. Mus., No. 9, p. 4 (as *Sphyrna tudes*)—Garman, Plagiost., p. 159.

Figure :—Day, Fish. India, pl. 188, fig. 4.

Dimensions :—To at least 3.33 mm.

Range :—Coasts and estuaries of Queensland, presumably from south to north. Tweed Heads, Moreton Bay, Cabbage-tree Creek, and Brisbane River (*Ogilby*). South Hill and Double Island Point—all S.Q.—(*Endeavour Coll.*).²⁴

Division B—**SQUALOIDEI**.

Family VII—**HETERODONTIDÆ**. "THE BULLHEAD OR PORT JACKSON SHARKS."

Genus 21—**HETERODONTUS** Blainville, Bull. Soc. Philom., 1816, p. 121 (*phillipi*). Syn.—*Cestracion* Cuvier 1817, not of Walbaum 1792 (q.v., p. 81).

35. **phillipi** Schneider.²⁵ "PORT JACKSON SHARK"; Common Bullhead; Low-crowned Bullhead. Oyster-crusher, Pigfish, and Bulldog Shark (*Kent*).

In Bloch, Syst. Ichth., 1801, p. 134: Botany Bay (as *Squalus philippi*)—Günther, Catal., viii, p. 415 (as *Cestracion philippi*)—MacLay & Macleay, Proc. Linn. Soc. N. S. Wales, iii, p. 309—Garman, Plagiost., p. 182 (as *Centracion philippi*).

Figures :—MacLay & Macleay, *ibid.*, pls. 22-24; McCoy, Prodr., pl. 113; Kent, Natur. in Austr., text-fig. p. 194.

Dimensions :—To at least 140 cm.

Range :—Coast of South Queensland. Moreton Bay (*Kent*).²⁶

Genus 22—**GYROPLEURODUS** Gill, Proc. Acad. Nat. Sci. Phila., 1862, p. 489 (*francisci*).

36. **galeatus** Günther. "CRESTED BULLHEAD."

Brit. Mus. Catal. Fish., viii, 1870, p. 416: Australia (as *Cestracion galeatus*)—MacLay & Macleay, *ibid.*, p. 313 (as *Heterodontus galeatus*)—Ogilby, Proc. Linn. Soc. N. S. Wales, xx, p. 245, description of teeth (as *Gyropleurodus sp.*)—Garman, Plagiost., p. 185 (as *Centracion galeatus*).

²⁴ This is much the most common hammerhead in Moreton Bay; the young ascend our rivers to the limit of the tideway.

²⁵ Orthographically corrected to assimilate it to the name of Governor Phillip, after whom it was called.

²⁶ The only knowledge I possess of the occurrence of this shark in Queensland waters has been gained through the following sentence published on page 193 of Mr. Saville Kent's "Naturalist in Australia." It "has been met with by the writer at such remote localities as Tasmania, Moreton Bay in Queensland, and Fremantle in Western Australia." Relying probably upon this statement Garman gives its habitat as "Queensland, Southern Australia, and New Zealand." In the seas of the latter it does not occur. It is quite unknown to me as a native of our seas, nor can I gain any confirmative evidence of its existence from the conversation of prominent fishermen both professional and amateur. As there is no local specimen in the State Museum Kent did not apparently consider it worth while to preserve his specimens. As a matter of fact I am very sceptical as to its occurrence in Moreton Bay, but in view of the explicit declaration quoted above I can not very well omit it. See also his "Great Barrier Reef," p. 267.

Figures :—Maclay & Macleay, *ibid.*, pl. 25 ; Waite, *Mem. Austr. Mus.*, iv, pl. 1 (*dentition*).

Dimensions :—To fully 110 cm.

Range :—Coast of South Queensland. Tweed Heads (*Ogilby*). This is a more northern species than the preceding and I was not, therefore, much astonished at learning of the capture of a specimen north of the Tweed, and the less so that the "Endeavour" trawled a fine example off Byron Bay. Further proof of its more northern range, as compared with *H. phillipi*, may be found in Waite's report that while the "Thetis" trawled that species at 14 stations between Shoalhaven Bight and Cape Hawke, not a single specimen of *G. galeatus* was taken.²⁷

Suborder *b*—HYPOTREMATA. "The Rays."

Family VIII—NARCACIONIDÆ.²⁸ "THE ELECTRIC RAYS."

Genus 23—**HYPNOS** Duméril, *Rev. & Mag. Zool.*, 1852, p. 277 (*subniger*).
Syn.—*Hypnarce* Waite 1902.

37. **subniger** Duméril. "NUMBFISH." Crampfish. Nummy (*Stead*).

Ibid., p. 279 : West Australia ; Günther, *Catal.*, viii, p. 453 ; Macleay, *Catal.*, 1113—Garman, *Plagiost.*, p. 304 (as *Hypnarce subnigrum*).

Figure :—Duméril, *ibid.*, pl. 12.

Dimensions :—To about 70 cm.

Range :—Coast of South Queensland. Moreton Bay (*Q.M.*) ; South Hill (*A.F.A.Q.*).

Division D—BATOIDEI. "The True Rays."

Subdivision SARCURA. "The Thick-tailed Rays."

Family IX—PRISTEIDÆ.²⁹ "THE SAWFISHES."

Genus 24—**PRISTIS** Linck, *Mag. neues Phys. u. Naturg.*, vi, 1790, p. 31 (*pristis*).

38. **zysron** Bleeker.

Nat. Tijds. Nederl. Ind., ii, 1851, p. 442 : Banjermassin ; Günther, *Catal.*, viii, p. 438 ; Macleay, *Catal.*, 1106 ; Garman, *Plagiost.*, p. 262.

Figure :—Day, *Fish. India*, pl. 191, fig. 2.

Dimensions :—To at least 6 mm.

Range :—Coast of Queensland from south to north.

²⁷ Waite, *ibid.*, p. 31.

²⁸ If Houttuyn's "Nat. Hist., 1764" be binomial, as is his 1782 work, these should respectively be *Torpedinoidei* and *Torpedinidæ*.

²⁹ The name is derived from the Greek *πρίστis*, gen. *πρίστews*, "a large kind of fish," and the family name should, therefore, by the laws of nomenclature be as above ; see

39. **microdon** Latham.

Trans. Linn. Soc. London, ii, 1794, p. 280 ; Garman, Plagiost., p. 265—
Günther, Catal., viii, p. 436 (as *P. perotteti*)—Ogilby, Ann. Queensl.
Mus., No. 9, p. 4 (as *P. zephyreus*).

Figures :—Latham, *ibid.*, pl. 26, fig. 4 (*rostrum*)—Day, Fish. Ind., pl. 191, fig. 1 (as *P. perotteti*).

Dimensions :—To fully 4.6 millim.

Range :—Coast of Queensland presumably from south to north. Moreton Bay (*Ogilby*).

40. **clavata** Garman.

Bull. Mus. Comp. Zool., xli, 1906, p. 208 : Coast of Queensland.

Figure :—Garman, Plagiost., pl. xvi, fig. 5.

Dimensions :—No data.

Range :—Coast of Queensland.

Family X—RHINOBATIDÆ. "THE GUITAR-FISHES."

Subfamily *a*—RHAMPHOBATINÆ.

Genus 25—**RHAMPHOBATIS** Gill, Ann. Lyc. Nat. Hist. New York, vii, 1861,
p. 408 (*ancylostoma*). Syn.—*Rhina* Schneider 1801, not of Walbaum
1792.

41. **ancylostoma** Schneider.

Bloch, Syst. Ichth., 1801, p. 352 : Coromandel Coast ; Ogilby, Ann. Queensl.
Mus., No. 9, p. 4 (as *Rhina ancylostoma*)—Günther, Catal., viii, p. 440
(as *Rhynchobatus ancylostomus*)—Garman, Plagiost., p. 267.

Figure :—Day, Fish. India, pl. 193, fig. 3.

Dimensions :—To at least 215 cm.

Range :—Coast of Queensland from north to south. Moreton Bay (*Ogilby*).
Dunk Island (*Banfield*).

Genus 26—**RHYNCHOBATUS** Müller & Henle, Arch. f. Nat., 1837, i, p. 399
(*lævis* = *djiddensis*).

42. **djiddensis** Forskal.

Descr. Anim., 1775, p. 18 : Jeddah (as *Raja djiddensis*)—Günther, Catal.,
viii, p. 441 ; Ogilby, Proc. Linn. Soc. N. S. Wales, x, p. 465 ; Garman,
Plagiost., p. 268.

Figure :—Day, Fish. India, pl. 192, fig. 1.

Dimensions :—To fully 215 cm.

Range :—Coast of Queensland from south to north. Moreton Bay (*Ogilby*).
Cartwright Point, S.Q. and Nor-West Islet, M.Q. (*Endeavour Coll.*).

Subfamily *b*—RHINOBATINÆ.

Genus 27—**RHINOBATUS** Walbaum, Artedi Gen., 1792, p. 581 (*rhinobatus*).
Syn.—*Syrrhina* Müller & Henle 1841.

43. **armatus** Gray. "SHOVELNOSE SHARK." (Text-fig. 1.)

In Hardwicke's Illustr. Ind. Zool., ii, 1834, pl. xcix; Müller & Henle, Plagiost., p. 119.

Figure :—ut supra.

Dimensions :—To at least 150 cm.

Range :—Coast of Queensland from south to north.³⁰

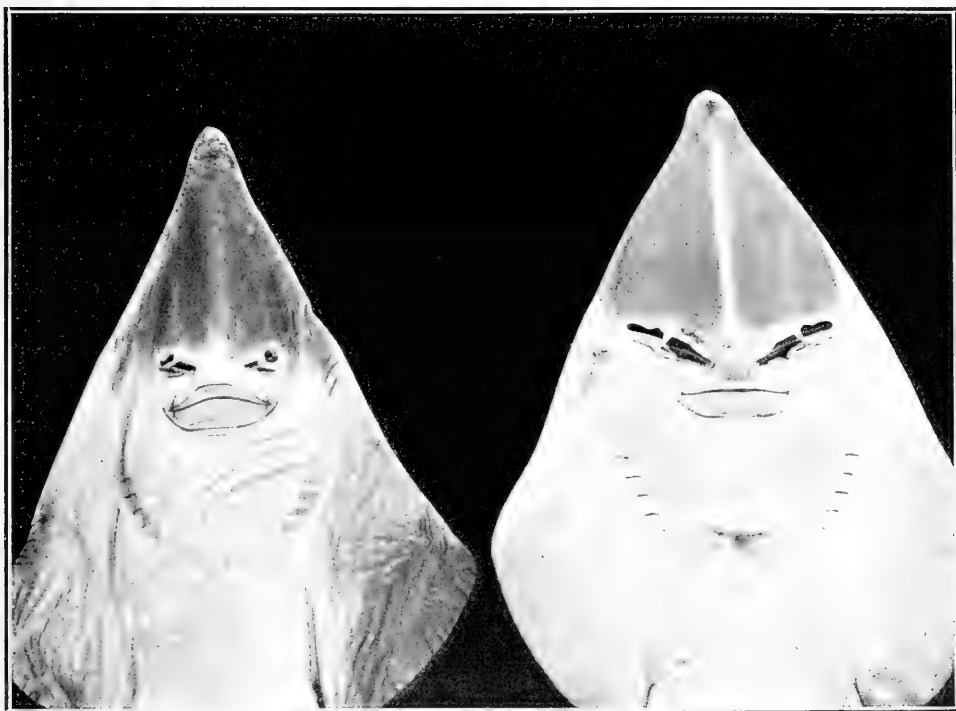
44. **banksii** Müller & Henle. (Text-fig. 2.)

Plagiost., 1841, pp. 123, 192 : New Holland ; Günther, Catal., viii, p. 446 ; Macleay, Catal., 1108—Ogilby, Proc. Linn. Soc. N. S. Wales, x, p. 464 (as *R. bougainvillii*)—Garman, Plagiost., p. 278 (as *R. philippi*). Not Müller & Henle.

Figure :—Waite, Mem. Austr. Mus., iv, pl. 3.

Dimensions :—To fully 125 cm.

Range :—Coast of South Queensland, straying beyond the Tropic. South Hill, Moreton Bay, Cartwright Point, Low Bluff, Double Island Point, Hervey Bay, Platypus Bay, and Bustard Bay, S.Q. ; Hummocky Island, M.Q. ; in 7 to 24 fath. (*Endeavour Coll.*).



Text-figure 1.—Genus RHINOBATUS.

R. banksii.

R. armatus.

³⁰ A much more littoral species than the succeeding, freely entering and even permanently residing and breeding in fresh water. This species was not once taken by the "Endeavour" on the Queensland Coast, whereas *R. banksii* occurred on 11 occasions.

Family XI—RAJIDÆ. "THE SKATES."

Genus 28—**RAJA** Linnaeus, Syst. Nat., ed. 10, i, 1758, p. 231 (*batis*).

45. **polyommata** Ogilby.

Some new Queensl. Fish., 20 Dec. 1910, p. 86 : Cape Moreton, S.Q.

Dimensions :—To at least 320 millim.

Range :—Coast of South Queensland. Cape Moreton to North Reef in 70 to 75 fath. (*Ogilby*).

46. **australis** Macleay.

Proc. Linn. Soc. N. S. Wales, viii, pt. 4, 21 Feb. 1884, p. 461 : Off South Head, Botany Bay, N.S.W., in 40 to 55 fath. ; Waite, Mem. Austr. Mus., iv, p. 40.

Figure :—Waite, *ibid.*, pl. 4.

Dimensions :—To about 500 millim.

Range :—Coast of South Queensland. Cape Moreton (*A.F.A.Q. Coll.*).

Subdivision MASTICURA. "The Whip-tailed Rays."

Family XII—DASYBATIDÆ.

Subfamily *a*—UROLOPHINÆ. "THE STINGAREES."

Genus 29—**UROLOPHUS** Müller & Henle, Arch. f. Nat. 1837, i, p. 400 (*cruciatius*). Syn.—*Trygonoptera* Müller & Henle 1841.³¹

47. **testaceus** Müller & Henle.³²

Plagiost., 1841, p. 174 : New Holland ; Garman, Plagiost., p. 410 (as *Trygonoptera testacea*)—Günther, Catal., viii, p. 486 ; Macleay, Catal., 1121.

Figure :—Müller & Henle, *ibid.*, pl. 57 ; Tosh, Mar. Biol. Rep., pl. 5, fig. 3.

Dimensions :—Width of disk to 30 cm.

Range :—Coast of South Queensland. Jumpin Pin (*Tosh*). Cape Moreton (*Q.M.*, *O.C.*). South Hill, Cape Moreton, Low Bluff, and Double Island Point (*Endeavour Coll.*).

³¹ Waite's discovery of a dorsal fin in fetal *U. cruciatius* (Mem. Austr. Mus., iv, p. 43) does away with the last shred of reason for the subdivision of this genus.

³² I have little faith in Günther's (Brit. Mus. Catal. Fish., viii, p. 351) Cape Upstart record of this species. In the Moreton Bay District *U. testaceus* is mainly a deep-water ray ; not once has it been obtained inside Moreton Bay, though it is the most abundant species captured in Port Jackson and the estuaries of the rivers of Middle New South Wales. Of the 113 examples trawled at four stations by the "Endeavour" no less than 92 were taken in one haul at a depth of 73 fath. off Cape Moreton in company with *Raja polyommata*, *Lophiomus laticeps*, and other deep-water forms, but it was absent from the two hauls off North Reef in 70 and 75 fath. respectively. Off Double Island Point, which lies about midway between Cape Moreton and North Reef, a single example was trawled in 33 fath., this being the most northerly station at which it was observed. That it should be found as a littoral species so far to the north as Cape Upstart, requires confirmation.

Subfamily *b*—DASYBATINÆ.Genus 30—**TÆNIURA** Müller & Henle, Arch. f. Nat., 1837, i, p. 400 (*lymma*).48. **lymma** Forskal. "LESSER FANTAIL RAY."Deser. Anim., 1775, p. 17: Jeddah (as *Raja lymma*)—Günther, Catal., viii, p. 483; Ogilby, Proc. Linn. Soc. N. S. Wales, x, p. 463; Garman, Plagiost., p. 309.*Figures*:—Lesson, Voy. Coquille, Zool., ii, pl. 3 (as *Trygon halgani*)—Müller & Henle, Plagiost., pl. 55, fig. 3 (*under side of head*).*Dimensions*:—Width of disk to about 300 millim.*Range*:—Coast of North Queensland. Green Island, Cairns (*Hamlyn Harris Coll.*). Cape York (*Ogilby*). Darnley Island (*Tosh Coll.*).49. **mortoni** Macleay.³³

Proc. Linn. Soc. N. S. Wales, viii, pt. 2, 17 July 1883, p. 212.: Lower Burdekin River, N.Q.

*Unfigured.**Dimensions*:—No data.*Range*:—Coast of North Queensland. Lower Burdekin River (*Macleay*).Genus 31—**HYPOLOPHUS** Muller & Henle, Arch. f. Nat., 1837, i, p. 400 (*sephen*).50. **sephen** Forskal. "GREAT FANTAIL RAY."Deser. Anim., 1775, p. 18: Jeddah (as *Raja sephen*)—Günther, Catal., viii, p. 482; Macleay, Proc. Linn. Soc. N. S. Wales, viii, p. 212 (as *Trygon sephen*)—Garman, Plagiost., p. 385 (as *Dasybatus sephen*).*Figure*:—Day, Fish. India, pl. 195, fig. 2.*Dimensions*:—Width of disk to at least 180 cm.*Range*:—Coast of Queensland from south to north. Moreton Bay, S.Q. (*Q.M., O.C.*). Lower Burdekin River, N.Q. (*Macleay*).Genus 32—**DASYBATUS** Walbaum, Artedi Gen. Pisc., 1792, p. 581 (*pastinaca*).Syn.—*Dasyatis* Rafinesque 1810; *Trygon* Adanson 1817.51. **kuhlii** Müller & Henle. "BLUE-SPOTTED STING RAY."Plagiost., 1841, p. 164; Günther, Catal., viii, p. 479 (as *Trygon kuhlii*)—Garman, Plagiost., p. 395.*Figures*:—Day, Fish. India, pl. 193, fig. 2; Tosh, Mar. Biol. Rep., pl. v, fig. 1.*Dimensions*:—Width of disk to at least 350 millim.*Range*:—Coasts and estuaries of Queensland from south to north. Coolangatta, Currumbin, Nerang Creek, Moreton Bay, and Brisbane River, S.Q. (*Ogilby*). Hervey Bay and Port Curtis, S.Q., Nor-West Islet and Edgumbe Bay, M.Q. (*Endeavour Coll.*).

³³ Without having seen either the one or the other Prof. Garman unites this species with *T. atra* Macleay from New Guinea. I labour under the same disadvantage, but before accepting his determination I must be satisfied that a ray, having the "head and body covered with small nitid granules" (*atra*), can possibly be identical with one which has the "disk covered with close minute spines" (*mortoni*). The difference may be sexual, but that is highly improbable.

52. *fluviorum* Ogilby. "ESTUARY RAY."

Proc. Roy. Soc. Queensl., xxi, 25 Aug. 1908, p. 6 : Brisbane River ; Garman, Plagiost., p. 394—Kent, Great Barrier Reef, p. 267 (as *Trygon pastinaca*).

Figure :—Tosh, Mar. Zool. Rep., pl. iv, fig. 3.

Dimensions :—Width of disk to at least 650 millim.

Range :—Bays and estuaries of South Queensland. Nerang Creek, Brisbane River, Moreton Bay, and Great Sandy Strait (*Ogilby*).

Genus 33—**HIMANTURA** Müller & Henle, Arch. f. Nat., 1837, i, p. 400 (*uarnak*).

53. *uarnak* Forskal. "COACHWHIP RAY."

Deser. Anim., 1775, p. 18 (as *Raja uarnak*)—Günther, Catal., viii, p. 473 ; Macleay, Catal., 1117 (as *Trygon uarnak*)—Garman, Plagiost., p. 376 (as *Dasybatus uarnak*).

Figure :—Annandale, Mem. Ind. Mus., ii, pls. 1-3.

Dimensions :—Width of disk to at least 155 cm.

Range :—Coast of Queensland from south to north. Moreton Bay, S.Q. (*Q.M.*, *O.C.*). Platypus Bay, S.Q. and Pine Peak, M.Q. (*Endeavour Coll.*). Burdekin River, N.Q. (*Macleay*). Goode Island, T.S. (*Tosh Coll.*).³⁴

Genus 34—**UROGYMNUS** Müller & Henle, Arch. f. Nat., 1837, i, p. 434

(*asperrimus* = *africanus*). Syn.—*Rhachinotus* Cantor 1849.

54. *africanus* Schneider. "THORNY RAY."

Bloch. Syst. Ichth., 1801, p. 367 (as *Raja africana*)—Günther, Catal., viii, p. 471 ; Macleay, Catal., 1116 (as *U. asperrimus*)—Garman, Plagiost., p. 374 (as *Rhachinotus africanus*).

Figure :—Day, Fish. India, pl. 195, fig. 1.

Dimensions :—Width of disk to at least 630 millim.

Range :—Coast of North Queensland. Cape York (*Macleay*). Darnley Island (*Tosh Coll.*).

Subfamily c—**PTEROPLATEINÆ**. "THE BUTTERFLY RAYS."

Genus 35—**PTEROPLATEA** Müller and Henle, Arch. f. Nat., 1837, i, p. 400 (*altavela*). Syn.—*Ætioplatea* Müller & Henle 1841.

55. *australis* Ramsay & Ogilby. "BUTTERFLY RAY." RAT-TAILED RAY.

Proc. Linn. Soc. N. S. Wales, x, pt. 4, 3 April 1886, p. 575 : Cape Hawke, N.S.W.

Unfigured.

Dimensions :—Width of disk to 100 cm.

Range :—Coasts of South and Middle Queensland. Moreton Bay, S.Q. (*Ogilby*). Off Port Curtis—Jenny Lind Buoy—S.Q., in 14 fath. ; Cape Gloucester in 25 fath. (*Endeavour Coll.*).³⁵

³⁴ If *H. gerrardi* be really distinct from this species, which I greatly doubt, Tosh's figure (Marine Biologist's Report 1903, p. 4, pl. 5, fig. 2) suggests its occurrence on our south coast (*Nerang Creek*).

³⁵ Garman's assumption of the identity of our species with *P. tentaculata* is distinctly unhappy; the constantly shorter annulated tail and uniformly umber brown coloration distinguish it at a glance from that species.

Family XIII—MYLIOBATIDÆE. "THE EAGLE RAYS" or "BULL RAYS."

Subfamily *a*—MYLIOBATINÆ.Genus 26—**MYLIOBATIS** (Duméril) Cuvier, Règne Anim., ii, 1817, p. 137 (*aquila*).56. **hamlyni** Ogilby. "PURPLE RAY."Ann. Queensl. Mus., No. 10, 1 Nov. 1911, p. 40: Moreton Bay, S.Q.—Macleay, Catal., 1122 (as *M. aquila*, name only).*Unfigured.**Dimensions*:—Width of disk in type 280 millim. Certainly attains a much larger size.*Range*:—Coast of South Queensland. Moreton Bay (*Ogilby*).³⁶Genus 37—**ÆTOBATUS** Blainville, Bull. Soc. Philom., 1816, p. 112 (*narinari*). Syn.—*Stoasodon* Cantor 1849.57. **narinari** Euphrasen. "JUMPING RAY."Vet. Akad. Nya. Handl., xi, 1790, p. 217: Brazil (as *Raia narinari*)—Günther, Catal., viii, p. 492; Macleay, Catal., 1125 (as *Ætobatis narinari*)—Garman, Plagiost., p. 441.*Figures*:—Jordan & Evermann, Fish. N. & M. Amer., pls. 15 & 16; Garman, ibid., pl. 49, figs 1-3 (*dentition*).*Dimensions*:—Width of disk to fully 4.5 mm.*Range*:—Coast of Queensland from south to north. Moreton Bay and Wide Bay, S.Q. (*Ogilby*). Cape York, N.Q. (*Macleay*).Subfamily *b*—RHINOPTERINÆ.Genus 38 — **RHINOPTERA** (Kuhl) Cuvier, Règne Anim., ed. 2, ii., 1829 (*marginata*).58. **neglecta** Ogilby. "COW-NOSE RAY."Mem. Queensl. Mus., i, 27 Nov. 1912, p. 32: Moreton Bay, S.Q.—de Vis, Proc. Roy. Soc. Queensl., ii, p. 12 (as *R. javanica*).*Unfigured.**Dimensions*:—Width of disk in type 860 millim.*Range*:—Coast of South Queensland. Moreton Bay (*de Vis*).³⁷

³⁶ This species is the antipodean representative of the North Atlantic *M. aquila*, from which it differs in dentition as noted by Günther (Catal., viii, p. 489). Otherwise the two forms agree so well that it might possibly be preferable to refer to the southern ray as *Myliobatis aquila hamlyni*. Kent, writing of his visit to Elliot Island, remarks:—"Large blue-spotted Sting Rays, *Myliobatis aquila*, bask lazily in the intervening sandy patches" (Great Barrier Reef, p. 103). This statement is certainly wrong as there is no evidence to show that the Bull Ray (*M. australis*) has ever been found in Queensland waters. Kent has evidently mistaken either *Dasybatus kuhlii*, or young *Ætobatus narinari*, or both for that species.

³⁷ Closely allied to, perhaps identical with, *R. jayakari* Boulenger from the Persian Gulf.

Family XIV—MOBULIDÆ. "THE SEA DEVILS."

Genus 39—**MOBULA** Rafinesque, Ind. Itt. Sicil., 1810, p. 61 (*auriculata*=*mobular*).59. **eregoodoo** Cantor. "HORNED RAY."Journ. Asiat. Soc. Bengal, xviii, 1849, p. 1420 : Sea of Pinang ; Günther, Catal., viii, p. 497 (as *Dicerobatis eregoodoo*)—Garman, Plagiost., p. 451.*Figures* :—Day, Fish. India, pl. 193, fig. 1 ; Kent, Great Barrier Reef, pl. 48, figs. 2 & 3.*Dimensions* :—Width of disk to at least 5.5 mm.*Range* :—Coast of Queensland from south to north. Moreton Bay (*Q.M.*, *O.C.*). Palm Islands (*Kent*).³⁸

APPENDIX A.

Under this heading will be found simple keys to (1) the families of the Queensland sharks and rays ; (2) the genera of such families as are not monotypic ; and (3) the species of the same.³⁹

By this means it is hoped that all those who are interested in nature-study, especially those in our schools and universities, may be enabled to identify such species as come within their purview, and thus little by little enlarge our knowledge. And it is not only by the addition of new or exotic species to the Queensland list that such knowledge may be extended, but it is of even higher importance to gain a closer insight into the habits, the comings and goings, and the limits of distribution of the common species with which we are familiar from day to day, but of whose inner life we are woefully ignorant. Only by the close observation of local workers along our whole coastline can this ignorance be dispelled. In such work the veriest tyro has an equal chance with the expert of making important discoveries.

KEY 1—OUR EUSELACHIAN FAMILIES.

*a*¹. *Pleurotremata* :—Gill-openings lateral.*b*¹. Two spineless dorsal fins ; anal fin present (*Galcoidei*).*c*¹. Eye without nictitating membrane.*d*¹. No oro-nasal grooves.*e*¹. Last gill-opening in front of base of pectoral.*f*¹. Dorsal fins subequal in size i. CARCHARIIDÆ.*f*². Second dorsal fin much smaller than first.*g*¹. Caudal fin much produced, the peduncle without keel ii. ALOPHIIDÆ.*g*². Caudal fin of moderate length, lunate, the peduncle strongly keeled iii. ISURIDÆ.*c*². Last one or two gill-openings above base of pectoral v. SCYLIORHINIDÆ.*d*². Oro-nasal grooves present iv. ORECTOLOBIDÆ.*c*². Eye with nictitating membrane vi. GALEIDÆ.*b*². Dorsal fins with or without a spine ; anal fin absent or present (*Squaloidei*).*h*¹. Each dorsal fin preceded by a spine ; anal fin present vii. HETERODONTIDÆ.*a*². *Hypotremata* :—Gill-openings ventral ; no anal fin.*i*¹. Electric organs present, between pectoral fins and head (*Narcacionoidei*) viii. NARCACIONIDÆ.*i*². No electric organs (*Batoidei*).*j*¹. Tail stout and muscular ; two dorsal fins (*Sarcura*).³⁸ Most of Kent's remarks on this fish refer more properly to *A. narinari*.³⁹ The genera and species which belong to monotypic families (so far as this State is concerned) may be easily identified by the family characters given in Key 1.

- l*¹. Trunk passing gradually into tail; ovoviviparous.
*l*¹. Snout much produced and saw-like, without tentacles ix. PRISTEIDÆ.
*l*². Snout not saw-like x. RHINOBATIDÆ.
*k*². Trunk abruptly contracted at base of tail; oviparous xi. RAJIDÆ.
*j*². Tail slender; dorsal fin absent or single and vestigial; ovoviviparous (*Masticura*).
*m*¹. Pectoral fins not produced anteriorly xii. DASYBATIDÆ.
*m*². Pectoral fins produced anteriorly to form cephalic appendages.
*n*¹. Teeth usually few, some or all laterally expanded; nostrils approximate
xiii. MYLIOBATIDÆ.
*n*². Teeth numerous and minute, sometimes absent in one or the other jaw; nostrils
xiv. MOBULIDÆ.
remote

KEY 2—OUR EUSELACHIAN SUBFAMILIES AND GENERA.

i. CARCHARIIDÆ :—Monotypic, *v. supra*.ii. ALOPIIDÆ :—Monotypic, *v. supra*.

iii. ISURIDÆ :—

*a*¹. *Isurinae* :—Teeth long, slender, smooth.*b*¹. Teeth without basal cusp 3. ISURUS.*a*². *Carcharodontinae* :—Teeth compressed, triangular, serrated 4. CARCHARODON.

iv. ORECTOLOBIIDÆ :—

*a*¹. *Ginglymostominae* :—Spiracles minute.*b*¹. Teeth in three series, multicuspoid; origin of second dorsal in advance of the anal 5. NEBRIUS.*a*². *Orectolobinae* :—Spiracles large.*c*¹. Lower lip with a symphysial groove; ovoviviparous.*d*¹. Teeth dissimilar; sides of head with a more or less interrupted series of dermal lobes
6. ORECTOLOBUS.*d*². Teeth all similar, small and tricuspid; sides of head without dermal lobes.*e*¹. Head strongly depressed; anal fin close to caudal 7. BRACHELURUS.*e*². Head not depressed; anal fin remote from caudal 8. HETEROSCYLLIUM.*c*². Lower lip without symphysial groove; oviparous, the egg-case bag-like.*f*¹. Caudal fin of moderate length 9. CHILOSCYLLIUM.*f*². Caudal fin greatly produced 10. STEGOSTOMA.

v. SCYLIORHINIDÆ :—

*a*¹. Angle of mouth with a distinct labial fold 11. HALÆLURUS.

vi. GALEIDÆ :—

*a*¹. Snout produced longitudinally, in direction of vertebral axis.*b*¹. *Mustelinae* :—Spiracles moderate.*c*¹. Teeth small and pavement-like 12. MUSTELUS.*b*². *Galeinae* :—Spiracles minute; teeth acute, serrated, depressed.*d*¹. No pit at base of caudal 13. GALEUS.*d*². Precaudal pit present 14. GALEOCERDO.*b*³. Spiracles absent; teeth acute.*e*¹. Teeth everywhere smooth, both base and cusp.*f*¹. Teeth strongly depressed.*g*¹. Some of the anterior teeth enlarged, their bases swollen and rounded 15. PHYSODON.*g*². None of the teeth enlarged, their bases narrow 16. SCOLIODON.*f*². Teeth erect or nearly so 17. APRIONODON.*e*². Bases of teeth serrated in one or both jaws, the cusps smooth.*h*¹. Teeth in lower jaw erect, in upper suberect and coarsely serrated on one or both sides of
base HYPOPRION.**h*². Teeth in both jaws depressed, their outer bases serrated 18. RHIZOPRION.*e*³. All or most teeth serrated on both base and cusp, their form variable 19. CARCHARHINUS.*a*². *Cestracioninae* :—Snout expanded laterally, at an angle to the vertebral axis 20. CESTRACION.

vii. HETERODONTIDÆ :—

- a*¹. Ramal symphyses long ; supraorbital ridges gradually decreasing in height posteriorly .. 21. HETERODONTUS.

- a*². Ramal symphyses short ; supraorbital ridges terminating abruptly behind .. 22. GYROPLEURODUS.

viii. NARCACIONIDÆ :—

- a*¹. Tail very short, with two dorsal fins ; spiracles close behind the eye, fringed .. 23. HYPNOS.

ix. PRISTEIDÆ :—Monotypic, *v. supra*.

x. RHINOBATIDÆ :—

- a*¹. *Rhampobatinæ* :—First dorsal fin originating above base of ventrals.

- b*¹. Snout short, broad, obtuse ; dental surface of jaws deeply undulous .. 25. RHAMPHOBATIS.

- b*². Snout narrow, produced, acute ; dental surface of jaws feebly undulous .. 26. RHYNCHOBATUS.

- a*². *Rhinobatinæ* :—First dorsal fin inserted well behind the ventrals.

- c*¹. Nasal valves not confluent 27. RHINOBATUS.

xi. RAJIDÆ :—

- a*¹. Ventral fins deeply notched ; dorsal fins far back, near tip of tail 28. RAJA.

xii. DASYBATIDÆ :—

- a*¹. Disk not or not much wider than long, the outer angles rounded or nearly so.

- b*¹. *Urolophineæ* :—Tail short, stout, muscular, terminating in a well-developed rayed caudal fin. 29. UROLOPHUS.

- b*². *Dasybatineæ* :—Tail moderate or long, without dorsal or caudal fin.

- c*¹. Caudal spine developed.

- d*¹. Tail moderate, inferiorly with a deep cutaneous fold which extends to its tip .. 30. TÆNIURA.

- e*¹. Dental surface of upper jaw angular ; tail inferiorly with a deep cutaneous fold, which is proximal in position, leaving a long free tip 31. HYPOLOPHUS.

- e*². Dental surface of jaws straight or undulous.

- f*¹. Tail moderate, with a low cutaneous fold on the upper or lower border, or on both .. 32. DASYBATUS.

- f*². Tail very long and slender, without folds 33. HIMANTURA.

- c*². Tail long, spineless, foldless ; back covered with osseous tubercles intermixed with spinigerous bucklers 34. UROGYMNUS.

- a*². *Pteroplateineæ* :—Disk much wider than long, the outer angles pointed ; tail short, slender, rat-like, the dorsal fin and caudal spine, when present, vestigial 35. PTEROPLATEA.

xiii. MYLIOBATIDÆ :—

- a*¹. *Myliobatineæ* :—Rostral lobe simple, median.

- b*¹. Teeth in several series, middle widest 36. MYLIOBATIS.

- b*². Teeth in a single series, very wide 37. AETOBATUS.

- a*². *Rhinopterineæ* :—Rostral lobe paired, lateral ; teeth in several series, middle usually widest 38. RHINOPTERA.

xiv. MOBULIDÆ :—

- a*¹. *Mobulineæ* :—Mouth inferior.

- b*¹. Teeth in the upper jaw only CERATOPTERA.*

- b*². Teeth in both jaws 39. MOBULA.

- a*². *Mantineæ* :—Mouth anterior.

- c*¹. Teeth in the lower jaw only. MANTA.*

Note :—None of the three genera to which an asterisk is attached has as yet been recorded from our coast, but *Hypoprion* has been included, both because the Indo-Malayan *H. macloiti* has been taken in Port Jackson, but more especially to demonstrate the dental differences which separate it from my genus *Rhizoprion*. *Manta* too has been known for many years from Port Jackson ; therefore in view of the wide tropical distribution of the mobuloid rays, and the difficulty of obtaining specimens owing to their huge bulk, it has been thought advisable to publish the above key to the genera, in order to facilitate the identification of such examples as may from time to time be captured.

KEYS TO THE SPECIES OF QUEENSLAND SELACHIANS.

1. CARCHARIAS :—

- a*¹. Head not depressed ; 4th and 5th teeth on each side of upper jaw much smaller than the adjacent teeth ; eye-diameter one fifth of preoral length 1. *arenarius*.

2. ALOPIAS :—

A single species, inhabiting the warmer parts of the Atlantic and Pacific Oceans ; *v. supra*, p. 74.

3. ISURUS :—

- a*¹. First dorsal originating close behind vertical from hinder angle of pectoral ; second dorsal partly before anal 3. *glaucus*.

4. CARCHARODON :—

Monotypic ; the single species inhabiting all warm seas ; *v. supra*, p. 74.

5. NEBRIUS :—

Monotypic ; an inhabitant of the warmer latitudes of the Indian & Western Pacific Oceans ; *v. supra*, p. 75.

6. ORECTOLOBUS :—

- a*¹. Nasal cirrus lobate.

*b*¹. Sides of head with a nearly continuous series of branched lobes.

*c*¹. Origin of first dorsal well postmedian 6. *ogilbyi*.

*b*². Sides of head with only a few widely spaced lobes.

*d*¹. Lobe of nasal cirrus bifid or trifid, rarely simple.

*e*¹. Body with large light ocelli 7. *maculatus*.

*e*². Body marbled, with distinct cross-bands 8. *ornatus*.

- a*². Nasal cirrus simple ; dermal lobes three on each side, widely separated and entire 9. *tentaculatus*.

7. BRACHÆLURUS :—

One species only, from Eastern Australia ; *v. supra*, p. 76.

8. HETEROSCYLLIUM :—

One species only, from South Queensland ; *v. supra*, p. 76.

9. CHILOSCYLLIUM :—

- a*¹. Fold of lower lip interrupted ; a large ocellus above the pectoral fin.

*b*¹. Body with large scattered dark spots 12. *ocellatum*.

*b*². Body with numerous small close-set dark spots 13. *trispiculare*.

- a*². Fold of lower lip continuous ; no ocellus above the pectoral fin.

*c*¹. Origin of first dorsal above anterior section of ventral-base 14. *punctatum*.

10. STEGOSTOMA :—

Monotypic ; inhabiting the warmer parts of the Indian and Western Pacific Oceans.

11. HALÆLURUS :—

- a*¹. Base of anal less than ano-caudal interspace.

*b*¹. Anterior nasal valve not overlapping mouth ; lower labial fold nearly reaching symphysis 16. *labiosus*.

12. MUSTELUS :—

- a*¹. Dorsal originating above inner angle of pectoral.

*b*¹. Teeth each with an obscure transverse ridge ; upper labial fold the longer 17. *antarcticus*.

13. GALEUS :—

- a*¹. Second dorsal and anal fins subequal ; snout somewhat produced, as long as width of mouth.

*b*¹. First dorsal equidistant from pectoral and ventral ; ventral originating well behind middle of length 18. *australis*.

14. GALEOCERDO :—

- α^1 . Monotypic ; inhabiting all tropical and temperate seas. 19. *arcticus*.

15. PHYSODON :—

- α^1 . Snout long ; labial folds short ; anal more than thrice as long as second dorsal 20. *mülleri*.
 α^2 . Snout short ; labial folds well developed ; anal less than twice as long as second dorsal 21. *taylori*.

16. SCOLIODON :—

- α^1 . Labial grooves very short.
 b^1 . Snout short, preoral length two fifths of head ; anal wholly in advance of second dorsal 22. *jordani*.
 b^2 . Snout long, preoral length more than half of head ; anal partly in advance of second dorsal.
 c^1 . First dorsal higher than long ; eye midway between tip of snout and fourth gill-opening 23. *affinis*.
 c^2 . First dorsal longer than high ; eye midway between tip of snout and first gill-opening 24. *acutus*.
 α^2 . Labial folds well developed, outer about one third ramal length.
 d^1 . Second dorsal five ninths of base of anal 25. *longmani*.

17. APRIONODON :—

- α^1 . Snout short and broad.
 b^1 . Second dorsal rather larger than and originating somewhat in advance of anal 26. *acutidens*.

18. RHIZOPRION :—

A single species from the coasts of South and Middle Queensland ; *v. supra*, p. 80.

19. CARCHARHINUS :—

- α^1 . Tail shorter than head and trunk ; snout broadly rounded 28. *stevensi*.
 α^2 . Tail as long as head and trunk.
 b^1 . Pectoral extending to below anterior third of first dorsal ; snout three fourths of width of mouth 29. *amblyrhynchus*.
 b^2 . Pectoral extending to below end of first dorsal.
 c^1 . Snout two thirds of width of mouth 30. *spenceri*.
 c^2 . Snout as long as width of mouth 31. *melanopterus*.

20. CESTRACION :—

- α^1 . Nostril remote from eye 32. *blochii*.
 α^2 . Nostril adjacent to eye.
 b^1 . Rostral dilation at nostril longer than wide ; narial groove less than one third width of head 33. *lewini*.
 b^2 . Rostral dilation at nostril wider than long ; narial groove more than one third width of head 34. *tudes*.

21. HETERODONTUS :—

- α^1 . Base of anal rather less than half of ano-caudal interspace 35. *phillipi*.

22. GYROPLEUROIDUS :—

- α^1 . Base of anal longer than ano-caudal interspace ; first dorsal originating above end of pectoral base 36. *galeatus*.

23. HYPNOS :—

Monotypic ; the single species inhabiting temperate Australia.

24. PRISTIS :—

α^1 . Posterior border of teeth grooved.

β^1 . Rostrum long and slender, its width behind the proximal pair about one ninth of its length ; lateral teeth 25 or more, the width of the 1st about one sixth of its distance from the 2nd ; no lower caudal lobe 38. *zysron*.

β^2 . Rostrum short and broad, its width behind the proximal pair about two ninths of its length ; lateral teeth 22 or less, the width of the 1st about two fifths of its distance from the 2nd ; lower caudal lobe present but inconspicuous 39. *microdon*.

α^2 . Lateral teeth 21, the posterior border rounded ; no lower caudal lobe 40. *clavata*.

25. RHAMPHOBATIS :—

A single species frequenting the shores of the warmer parts of the Indian and Western Pacific Oceans ; *v. supra*.

26. RHYNCHOBATUS :—

α^1 . Dorsal originating above base of ventrals 42. *djiddensis*.

27. RHINOBATUS :—

α^1 . Internarial width less than half the narial diameter ; spiracle with two conspicuous folds 43. *armatus*.

α^2 . Internarial width three tenths more than narial diameter ; spiracle without folds 44. *banksii*.

28. RAJA :—

α^1 . Lavender-gray or pale brown with groups of small black spots, which are white-edged in the young ; size small 45. *polyommata*.

α^2 . Fulvous brown, uniform or with obscure lighter spots ; size moderate 46. *australis*.

29. UROLOPHUS :—

α^1 . Width of mouth less than two fifths of preoral length 47. *testaceus*.

30. TÆNIURA :—

α^1 . Skin of back smooth ; fuscous, with sky-blue spots and bands 48. *lymma*.

α^2 . Skin of back spinigerous ; brown, without spots or bands 49. *mortoni*.

31. HYPOLOPHUS :—

A single species inhabiting the warmer parts of the Indian and Western Pacific Oceans ; *v. supra*, p. 87.

32. DASYBATIS :—

α^1 . Disk two thirds of tail ; buccal papillæ two ; pale brown or yellow, blue-spotted 51. *kuhlii*.

α^2 . Disk four ninths of tail ; buccal papillæ seven ; uniform olive-brown 52. *fluviorum*.

33. HIMANTURA :—

α^1 . Tail at least thrice the length of the body ; buccal papillæ four or more ; uniform sandy brown 53. *uarnak*.

34. UROGYMNUS :—

A single species, inhabiting the warmer parts of the Indian and Western Pacific Oceans ; *v. supra*, p. 88.

35. PTEROPLATEA :—

α^1 . Tail three eighths of the length of the disk, annulated brown and yellow, or white blotched with black 55. *australis*.

36. MYLIOBATIS :—

α^1 . Lower jaw with nine series of ventral plates, the width of the first three sevenths of that of last ; base of dorsal more than half its distance from ventral base 56. *hamlyni*.

37. AETOBATUS :—

α^1 . Snout broadly rounded ; back white-spotted 57. *narinari*.

38. RHINOPTERA :—

α^1 . Disk more than twice as wide as long ; upper median tooth two thirds wider than adjacent tooth 58. *neglecta*.

39. MOBULA :—

α^1 . No caudal spine ; disk two thirds of length of tail *eregoodoo*.

Note :—In the British Museum Catalogue of Fishes (viii, p. 486) Dr. Günther records a specimen of *Callorhynchus antarcticus* from Cape Upstart. The only cape of that name is on the coast of Queensland near Bowen, and as it is very certain that no callorhynchid was ever caught within hundreds of miles of that place, the species must be expunged from our list.

Class IV—PISCES.

Subclass TELEOSTEI.

Order I—ISOSPONDYLI.

Suborder *a*—CLUPEOIDEI. "The Herrings, etc."

Family I—ELOPIDÆ. "THE TARPONS."

Genus 1—**MEGALOPS** (Commerçon) Lacépède, Hist. Nat. Poiss., v, 1803, p. 289 (*filamentosus* = *cyprinoides*). Syn.—*Brisbania* Castelnau 1878.

1. **cyprinoides** Broussonet. "OX-EYE HERRING."

Ichthyologia, 1782, pl. 9 (as *Clupea cyprinoides*)—Günther, Catal., vii, p. 471; Macleay, Proc. Linn. Soc. N. S. Wales, iv, p. 383—Castelnau, Proc. Linn. Soc. N. S. Wales, ii, p. 242 (as *Brisbania staigeri*).

Figure:—Castelnau, *ibid.*, pl. 3.

Dimensions:—To about 600 millim.⁴⁰

Uses:—An excellent table fish.

Range:—Coasts of Queensland from south to north, ascending rivers.

Genus 2—**ELOPS** Linnaeus, Syst. Nat., ed. 12, 1766, p. 518 (*saurus*).

2. **hawaiiensis** Regan. "BANANA FISH."

Ann. & Mag. Nat. Hist. (8) iii, 1909, p. 39: Hawaii; Ogilby, Mem. Queensl. Mus., iii, p. 133—Regan, *ibid.* (as *E. australis*).

Figure:—Jordan & Richardson, Mem. Carnegie Mus., iv, pl. 66, fig. 1.

Dimensions:—To at least 600 millim.

Uses:—Of good flavour, but not equal to the preceding.

Range:—Coasts of Queensland from south to north.

Family II—ALBULIDÆ. "THE LADY-FISHES."

Genus 3—**ALBULA** Gronow, Zoophyll., 1763, p. 102.

3. **glossodonta** Forskal. "LADY-FISH."

Descr. Anim., 1775, p. 68: Jeddah (as *Argentina glossodonta*)—Jordan & Evermann, Bull. U.S. Bur. Fisher., xxiii, p. Ogilby, Proc. Roy. Soc. Queensl., xxi, p. 87 (as *A. vulpes*).

Figure:—Bleeker, Atlas Ichth., vi, pl. 12, fig. 1 (as *Conorhynchus glossodon*).

Dimensions:—To about 900 millim.

Uses:—Held in little estimation for the table.

Range:—Coasts of Queensland from south to north.

Family III—CHIROCENTRIDÆ. "THE WOLF HERRINGS."

Genus 4—**CHINOCENTRUS** Cuvier, Règne Anim., ed. 1, ii, 1817, p. 178(*dorab*).

4. **dorab** Forskal. "WOLF HERRING."

Descr. Anim., 1775, p. 72; Red Sea (as *Clupea dorab*)—Günther, Catal., vii, p. 475; Macleay, Catal., 905.

⁴⁰ Neither I nor any of our local fishermen have ever seen or heard of a specimen exceeding the above measurement, and we look with grave suspicion on the statement published by Kent, and copied by Stead, that it attains a length of five feet on our coast.

Figure :—Bleeker, Atlas Ichth., vi, pl. 271, fig. 3.

Dimensions :—To a length of 1800 millim. "It grows to six feet in India, but specimens from New Guinea up to twelve feet are recorded" (*Day*).

Uses :—"While of good flavor, it is unfortunately so full of small bones as to be almost useless . . . could probably be turned to good account if cut into suitable lengths and preserved in tins, after the manner of sardines, under such conditions that the bones would be dissolved . . . highly prized as a bait for the capture of the giant perch, *Lates calcarifer*" (*Kent*).

Range :—Coasts of Queensland from south to north.

Family IV—CHANEIDÆ. "THE MILK-FISHES."

Genus 5—**CHANOS** Lacépède, Hist. Nat. Poiss., v, 1803, p. 295 (*arabicus* = *chanos*). Syn.—*Lutodeira* Rüppell 1905.

5. **chanos** Forskal. "MORETON BAY SALMON."

Descr. Anim. 1775, p. 74 : Jeddah (as *Mugil chanos*)—Günther, Catal., vii, p. 473 ; Macleay, Catal., 904 (as *Chanos salmoneus*).

Figure :—Bleeker, Atlas Ichth., vi, pl. 272, fig. 4 (as *C. salmoneus*).

Dimensions :—Attains a length of at least 1200 millim.

Uses :—One of our most delicious food fishes.

Range :—Coasts of Queensland from south to north, entering fresh water.

Family V—CLUPEIDÆ.

Subfamily a —DUSSUMIERIINÆ. "THE ROUND HERRINGS."

Genus 6—**STOLEPHORUS** Lacépède, Hist. Nat. Poiss., v, 1803, p. 381 (*japonicus*). Syn.—*Spratelloides* Bleeker 1852.⁴¹

6. **delicatulus** Bennett.

Proc. Zool. Soc. London, i, 1830, p. 168 : Mauritius (as *Clupea delicatula*)—Günther, Catal., vii, p. 464 ; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, p. 350 (as *Spratelloides delicatulus*).

Figure :—Bleeker, Atlas Ichth., vi, pl. 264, fig. 3.

Dimensions :—To 80 millim.

Uses :—"A very delicate and delicious fish" (*Macleay*). "Might doubtless be turned to commercial account" (*Kent*).

Range :—Coast of North Queensland. Darnley Island (*Alleyne & Macleay*). Many of the inter-tropical districts of the Queensland Coast (*Kent*). Murray Island (*McCulloch*).

⁴¹ Weber and Beaufort (Verh. Kon. Akad. Amsterdam (2) xvii, 1912, No. 3, p. 20) base their objection to the use of Lacépède's name for these fishes on the fact that his second species is undeniably an anchovy ; but since the first species mentioned by him, the *Atherina japonica* of Houttuyn, is not congeneric with his second species, *S. commersonianus*, it follows that, so far as the genus *Stolephorus* is concerned, the latter has no standing whatever.

7. **robustus** Ogilby. "BLUE SPRAT."

Proc. Linn. Soc. N. S. Wales, xxii, pt. 1, 17 Sept. 1897, p. 64 (as *Spratelloides robustus*)—id., Ann. Queensl. Mus., No. 9, p. 5.

Unfigured.

Dimensions :—To about 100 millim.

Uses :—A delicious little fish, which would make an excellent sardine.

Range :—Coast of South Queensland, visiting our shores in enormous shoals during the winter months.

Genus 7—**DUSSUMIERIA** Cuvier & Valenciennes, Hist. Nat. Poiss., xx, 1847, p. 467 (*acuta*).

8. **hasseltii** Bleeker.

Nat. Tijds. Nederl. Ind., i, 1851, p. 422 : Java ; Ogilby, Mem. Queensl. Mus., iii, p. 134.

Figure :—Bleeker, Atlas Ichth., vi, pl. 271, fig. 2.

Dimensions :—To at least 170 millim.

Range :—Coast of North Queensland. Cape York (*Ogilby*).

Subfamily β —**HYPERLOPHINÆ**. "THE ROUGH-BACKED SPRATS."

Genus 8—**HYPERLOPHUS** Ogilby, Rec. Austr. Mus., ii, pt. 2, Aug. 1892, p. 26 (*sprattellides*). Syn.—*Omochetus* (subgenus) Ogilby 1897.

9. **sprattellides** Ogilby. "SILVER SPRAT."

Ibid., p. 24 (as *Clupea sprattellides*)—id., Proc. Linn. Soc. N. S. Wales, xx, 1897, p. 72 (as *H. copii*).

Unfigured.

Dimensions :—To about 100 millim.

Uses :—A delicate and delicious little fish ; "destined to become the very finest sardine of commerce" (*Ogilby*).⁴²

Range :—Coasts of South Queensland, visiting our bays and sandy beaches in immense shoals during the winter months.

Subfamily γ —**CLUPEINÆ**. "THE TRUE HERRINGS."

Genus 9—**AMBLYGASTER** Bleeker, Journ. Ind. Arch., iii, 1849, p. 70 (*clupeoides*). Syn.—*Clupanodon* Jordan & Evermann 1896 ; not of Lacépède 1803.

10. **neopilchardus** Steindachner. "PILCHARD."

Denk. Akad. Wien., xli, 1879, p. 12 (as *Clupea neopilchardus*)—Castelnau, Proc. Zool. Soc. Vic., i, p. 187 ; Macleay, Proc. Linn. Soc. N. S. Wales, iv, p. 371 (as *C. sagax*)—Ogilby, Rep. Mar. Dept. Queensl., 1911, p. 15.

Figure :—Ogilby, Edib. Fish. N. S. Wales, pl. 45 (as *C. sagax*).

Dimensions :—To at least 280 millim.

Uses :—An excellent food-fish, which will some day be recognized as a valuable national asset.

Range :—Coast of South Queensland to as far north as Hervey Bay. Moreton Bay (*Ogilby*). Off Cape Moreton (*Endeavour Coll.*).

⁴² Queensland Naturalist, ii, p. 30.

A REVISION OF THE AUSTRALIAN THERAPONS WITH NOTES ON SOME PAPUAN SPECIES.

BY J. DOUGLAS OGILBY AND ALLAN R. McCULLOCH.

(Plates X to XIII and One Text-figure.)

INTRODUCTION.

THE very confused literature relating to the Australian species of the genus *Therapon* and their allies has been the cause of considerable difficulty in their identification. Many closely related forms, which were insufficiently described by their authors, have hitherto remained almost unknown, and their rediscovery, without reference to the types, has been almost or quite impossible. We are fortunate, therefore, in having access to the large series of specimens included in the collections of the Queensland Museum, the Australian Museum, and the Macleay Museum at the University of Sydney, where are preserved most of the types of the several species briefly defined by Count Castelnau, Sir William Macleay, and Mr. C. W. de Vis. These we have examined and redescribed in detail when necessary, and have effected considerable changes in their synonymy. Figures are given of all those species of which no reliable illustrations have been published, while the better-known forms are shortly defined for their easy recognition.

We wish to acknowledge here the invaluable assistance afforded us by Dr. Thomas L. Bancroft, of Eidsvold on the Burnett River, Queensland, who has spared no pains to secure beautifully preserved material for us from various localities. Without his help, much of the matter dealt with in the following pages would have remained unknown. We are also indebted to Mr. Ellis Troughton and Mr. Frank McNeil, of the Australian Museum, for much patient help in counting the scales of large series of specimens, and other assistance.

THERAPON Cuvier.

Therapon Cuvier, Règne Anim., ed. 1, ii, 1817, p. 295 (*Holocentrus servus* Bloch). Lapsus calami for *Therapon*.

Therapon Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 125; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 274; Day, Fish. India, pt. i, 1875, p. 68; Bleeker, Atlas Ichth., vii, 1876, p. 110; Ogilby, Edib. Fish. N. S. Wales, 1893, p. 26; Jordan & Thompson, Proc. U. S. Nat. Mus., xli, 1912, p. 535.

Datnia Cuvier & Valenciennes, ibid., p. 138 (*D. argentea* Cuv. & Val.).

Pterapon Gray, in Hardwicke, Illustr. Ind. Zool., 1832. Nomen emend.

Mesopristes Bleeker, Arch. Néerl. Sci. Nat., xi, 1876, p. 267 (*M. macracanthus* Blkr. = *T. argenteus* C. & V.); id., Atlas Ichth., vii, 1876, p. 110.

Autisthes de Vis, Proc. Linn. Soc. N. S. Wales, ix, pt. 2, 19 Aug. 1884, p. 398 (*A. argenteus*, de Vis = *T. puta* Cuv. & Val.).

Eutherapon Fowler, Proc. Acad. Nat. Sci. Phila., 1904, p. 527 (*T. theraps* Cuv. & Val.).

Body ovate to elliptical, more or less compressed. Scales small or moderate, adherent, finely ctenoid. Lateral line continuous, extending on the base of the caudal,

the tubes simple, not quite reaching the margin of the scale. Head large, with moderate or rather long snout and narrow preorbital, partly covered with small, usually cycloid scales. Mouth terminal and protractile, with moderate, oblique cleft, the jaws equal; lips rather thick, plicate; maxillary exposed distally. Teeth in a band in each jaw variable in form; on the vomer and palatines, if present, caducous. Preorbital serrated in the young, preopercle more or less strongly serrated; opercle with one or two pungent spines; suprascapular and coracoid bones generally exposed. One more or less deeply notched dorsal fin, with xii-xiii (rarely xi or xiv) 8-14 rays, the spinous portion longer than the soft and depressible in a groove. Caudal fin rounded, or truncate, or emarginate, with 17 principal rays, 15 of which are divided. Anal short, with iii 7-12 rays. Pectoral with 12 to 16 rays, varying from pointed and asymmetrical to rounded and symmetrical. Ventrals close together, inserted well behind the pectorals. Gill-membranes separate, free from the isthmus; six branchiostegals; pseudobranchiae large; gill-rakers in moderate number, short and stout. Air-bladder large, mesially constricted. Pyloric appendages in small or moderate number. Vertebrae $12+13=25$. Ribs inserted on parapophyses. (*θ ῥάπων*, an attendant.)

Fishes of small or moderate size from the Indian and Western Pacific Oceans and the fresh waters of Australia and New Guinea.

In its commonly accepted form, the genus *Therapon* includes a number of very dissimilar fishes, the typical forms of which are almost entirely marine, while others are estuarine, and many are confined strictly to fresh waters. Their affinities have been subject to considerable discussion by various authors, and they have been included in the families *Pristipomatidae* by Günther, and in the *Lutjaninae* by Boulenger, while Jordan and his colleagues have adopted the family *Theraponidae* to accommodate them. Regan, having examined the skeletal characters, regards *Therapon* as a Serranid.

Their subdivision into natural groups has been attempted by several writers with more or less success. Cuvier and Valenciennes distinguished *Datnia* and *Pelates* in 1829, which, however, have been reunited with *Therapon* by most authors.¹

The latter genus is readily separable by the junction of the gill-membranes with the isthmus and by its dentition, but we are unable to define the former, though its general appearance is very different to that of the typical *Therapon*. *Eutherapon* has been founded on *T. theraps* by Fowler which has larger scales than the typical *T. servus*. The relative lengths and strength of the dorsal and anal spines, and the presence or absence of strong bony ridges on the cranium, suggest characters which might be used for subdivision purposes, as also does the varying structure of the scales. The extremes of all these apparently merge one into another, however, and any one character is not always constant in obviously closely related species. An investigation of the skeletal characters may reveal a ready means of subdivision, but we have been unable to undertake this phase of the work.

The freshwater species of Australia include such widely diverse representatives as the small-scaled *T. bidyana* in which the suprascapular bone is exposed, and *T. percoides* in which it is hidden and the scales are large. They are united, however, by a chain of intermediate forms which appear to defy subdivision, so we reluctantly accept the genus *Therapon* in its broad sense, distinguishing only *Pelates* as a well-defined group.

¹ The genus *Helotes* Cuvier & Valenciennes has also been included in the synonymy of *Therapon* by some authors, but the trilobate character of its teeth is apparently constant, and readily distinguishes it from its allies.

As is usual in freshwater fishes with a wide range, the Australian fluviatile Therapons exhibit considerable variation in both form and colour-marking, and it is only by an examination of large series of specimens that we have been able to determine, to our own satisfaction, the limits of the various species referred to in this paper. The fin-formulæ are generally constant, but in the widely distributed *T. unicolor* even the number of dorsal spines varies from eleven to thirteen. The scale-counts, though variable within certain limits, appear to afford useful characters for the discrimination of species. Owing to the irregularity of the squamation, however, the scales must be counted in series, preferably upwards and backwards, and not individually. We have found the number of scales between the lateral line and the middle of the spinous dorsal fin (supralateral scales), and excluding the dorsal sheath, to afford a ready guide to some species.

The freshwater Therapons range over the whole of Australia, and though most abundant in the well-watered parts of Queensland, at least two species, *T. unicolor* and *T. percoides*, extend into the small streams and waterholes of Central Australia. Some are evidently capable of resisting long periods of drought by lying dormant in the mud at the bottom of the pools in which they find themselves, until the advent of rain, and consequent filling of the pools with water, again vitalises them into fresh activities. They are a valuable item in the food supply of both aborigines and colonists, some species attaining considerable proportions. The marine species, though edible, are but little valued as food.

The species here dealt with may be distinguished by the following key :—

- a¹. Lower opercular spine greatly developed, produced beyond the opercular lobe. Body with longitudinal dark bands; vertical fins with dark markings, spinous dorsal with a large dark blotch.
 - b¹. Scales larger, 7½-8 supralateral scales *theraps*.
 - b². Scales smaller, 13-15 supralateral scales.
 - c¹. Body narrower, the depth slightly less than the length of the head; longitudinal bands almost straight *pula*.
 - c². Body deeper, the depth slightly greater than the length of the head; longitudinal bands strongly curved *servus*.
- a². Lower opercular spine smaller, not produced beyond the opercular lobe; coloration various, no large dark blotch on the spinous dorsal.
 - d¹. Suprascapular bone not exposed, hidden by scales.
 - e¹. Normally thirteen dorsal spines.
 - f¹. 33-38 series of scales; body with five narrow dark cross-bars *percoides*.
 - f². 52-56 series of scales; caudal fin with a broad oblique bar on each lobe *caudovittatus*.
 - e². Normally twelve dorsal spines (rarely xiii or xi); coloration nearly uniform, or with small dark spots *unicolor*.
 - d². Suprascapular bone exposed, not hidden by scales.
 - g¹. Normally twelve dorsal spines.
 - h¹. Scales smaller, 75-90 between the origin of the lateral line and the hypural joint.
 - i¹. Nostrils close together; coloration nearly uniform *bidyana*.
 - i². Nostrils widely separate; a dark shoulder-mark and dark cross-bars on the body; fins spotted *humeralis*.
 - h². Scales larger, less than 60 between the origin of the lateral line and the hypural joint.
 - j¹. Dorsal and anal spines very strong, longest dorsal spine longer than the rays, and second anal spine much longer than the third.
 - k¹. Nostrils close together; maxillary entirely covered by the lip *interruptus*.
 - k². Nostrils well separated; angle of the maxillary not covered by the lip *argenteus*.
 - j². Dorsal and anal spines weaker, the longest dorsal spine not longer than the rays, second anal spine not or but little longer than the third.

- ¹l. Caudal fin slightly rounded : eleven anal rays *carbo*.
¹2. Caudal fin emarginate : eight to ten anal rays.
^m1. 46-50 series of scales below the lateral line *fuliginosus*.
^m2. 51-55 series of scales below the lateral line *bancrofti*.
^q2. Normally thirteen dorsal spines.
ⁿ1. $6\frac{1}{2}$ - $7\frac{1}{2}$ supralateral scales ; head larger, one third or more than one third of the length to the hypural ; body with dark bands, and dark spots at base of caudal *trimaculatus*.
ⁿ2. 8-11 supralateral scales ; head smaller, less than one third of the length to the hypural ; coloration nearly uniform.
^o1. Scales smaller, 58-67 below the lateral line and 63-71 above it *hillii*.
^o2. Scales larger, 49-56 below the lateral line and 51-61 above it *parriceps*.

THERAPON THERAPS Cuvier & Valenciennes.

- Therapon theraps* Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 129, pl. liii ; Günther, Brit. Mus. Cat. Fish., i, 1859, p. 274 ; Day, Fish. India, 1878, p. 70, pl. xviii, fig. 6 ; Castelnau, Proc. Zool. Soc. Vict., ii, 1873, p. 8^f ; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 270 ; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 360 ; Weber, "Siboga" Exped., lvii, 1913, p. 255, fig. 64—color variations of young.
Therapon obscurus Cuvier & Valenciennes, ibid., p. 135 ; Günther, ibid., p. 275.
Therapon squallidus Cuvier & Valenciennes, ibid., p. 156 ; Günther, ibid.
Therapon transversus Cuvier & Valenciennes, ibid., p. 137 ; Günther, ibid.
Therapon cinereus Cuvier & Valenciennes, ibid., p. 138 ; Günther, ibid., p. 276.
[?]*Datnia virgata* Cuvier & Valenciennes, ibid., vii, 1831, p. 480.
[?]*Therapon virgatus* Günther, ibid., p. 276.
[?]*Therapon rubricatus* Richardson, Ann. Mag. Nat. Hist., ix, 1842, p. 127.
Therapon (Datnia) theraps Bleeker, Atlas Ichth., vii, 1876, p. 111, pl. ccxxi, fig. 1.
Therapon nigripinnis Macleay, ibid., p. 366.

D. xii 10 ; A. iii 8-9 ; P. 14-15 ; V. i 5 ; C. 17. 56-59 series of scales between the origin of the lateral line and the hypural joint, counted above the lateral line, and 49-50 below it ; 7-8 between the lateral line and the middle of the spinous dorsal. Cheek-scales in 5-6 rows.

Proportions of an Australian specimen 153 mm. long :—Depth 3.2 in the length to the hypural joint ; head 3.5 in the same. Eye equal to the length of the snout, 3.5 in the head, and a little greater than the interorbital space which is 4.2 in the head. Fourth dorsal spine 1.6, anterior dorsal ray 2.2, third anal spine 2.6, and anterior anal ray 2.2 in the head.

Body ovate, compressed. Upper surface of cranium closely covered with exposed, arborescent bony ridges. Preorbital more or less serrated. Preoperculum evenly denticulate, the teeth largest on the broadly rounded angle. Suprascapular and coracoid bones strongly denticulate. Operculum with two spines, the lower produced beyond the opercular lobe. Maxillary reaching to below the anterior portion of the eye. Nostrils large, with skinny, lobular margins ; they are separated by a space equal to their own diameter.

Dorsal spines strong, the fourth the longest and much higher than the rays ; the last is much longer than the penultimate one : the margin of the soft dorsal is straight and pointed posteriorly. Third anal spine longer than the second but shorter than the anterior rays : margin of the soft anal a little excavate, pointed posteriorly. Pectorals and ventrals pointed, the first ray of the latter with a short filament which does not reach the vent. Caudal emarginate.

Color-marking greatly developed in the young, less distinct or wanting in adults. Color more or less silvery in preservative with three broad, longitudinal, dark

bands ; the upper covers the greater portion of the back, and the second extends from the eye to the upper half of the caudal peduncle. A large black blotch on the membrane between the third and seventh spines which is variable in size. Soft dorsal and anal fins with striking black and white markings in the young which are greatly reduced in larger examples. Caudal fin with a median horizontal and two oblique bars, together with large blackish patches which cover the greater part of each lobe.

The foregoing description is based on six specimens 83-169 mm. long, of which two are from India, being part of Dr. Day's collection. The type of *T. nigripinnis* Macleay, from Rockingham Bay, Queensland, does not differ from them in any structural details, though its markings are very obscure. *Therapon rubricatus* Richardson was based upon a color drawing of a fish from North-Western Australia ; it has been regarded as probably identical with *T. theraps* by Day and Bleeker, and there seems to be no reason to doubt their conclusion.

T. theraps has been recorded from the following Australian localities :—Port Essington, North Australia (*Richardson*) ; North-Western Australia (*Richardson*, as *T. rubricatus*) ; Port Darwin, North Australia (*Castelnau*) ; Palm Island to Flinders Island, Queensland (*Alleyne & Macleay*) ; Rockingham Bay, Queensland (*Macleay*, as *T. nigripinnis*). We have examined specimens from the Burnett River and Yam Creek, Queensland, and Torres Strait.

THERAPON PUTA Cuvier & Valenciennes.

Therapon puta Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 131 ; Valenciennes, Illustr. Poiss. Cuv. Règne Anim., 1843, pl. xii, fig. 2 ; Day, Fish. India, 1875, p. 69, pl. xviii, fig. 3.

Therapon ghebul (Ehrenberg) Cuvier & Valenciennes, *ibid.*, p. 133 ; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 281.

Therapon trivittatus Günther, *ibid.*, p. 280 ; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 361 (Not *Coius trivittatus* H. Buchanan.)

Therapon (Datnia) puta Bleeker, Atlas Ichth., vii, 1876, p. 112, pl. ccxci, fig. 2.

Autisthes argenteus de Vis, Proc. Linn. Soc. N. S. Wales, ix, 1884, p. 398.

D. xi i 10 ; A. iii 9. About 100 series of scales above the lateral line between its origin and the hypural joint, and about 90 below it ; 12-13 scales between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in about 6 rows.

Proportions of a specimen 103 mm. long :—Depth 3.7 in the length to the hypural joint ; head 3.3 in the same. Eye 3.7 in the head, a little longer than the snout and the interorbital width. Snout 4, interorbital width 4.3 in the head. Fifth dorsal spine 1.6, first dorsal ray 1.8, and third anal spine 2.1 in the head.

Body elongate, compressed. Cranium and interorbital space with low bony ridges. Preorbital finely serrated. Preoperculum with spines on the posterior margin which are very strong and enlarged on the angle ; lower margin denticulate. Lower opercular spine enlarged and produced beyond the opercular lobe. Suprascapular exposed, denticulate. Fifth dorsal spine longest and higher than the anterior rays ; the last spine is much longer than the penultimate one. Third anal spine longer than the second.

Light brown on the back, paler below. Three or four dark bars, which are almost straight, extend along the sides ; the first commences on the nape and runs close to the dorsal profile to the end of the spinous dorsal ; the second from above the nostrils to the soft dorsal and along the back of the caudal peduncle ; the third from the snout to the upper half of the caudal peduncle ; the fourth, if present, from behind the pectoral to the lower half of the caudal peduncle. The third bar extends along the middle of the caudal fin which also bears two oblique bars on each lobe. Spinous dorsal with a large black blotch, soft dorsal and anal with darker oblique bars.

The above definition is based on two specimens 95 and 103 mm. long from Manila, Philippine Islands. The species has been recorded from Torres Strait by Macleay as *T. trilineatus*, and from the Queensland coast by de Vis under the name *Autisthes argenteus*. The specimen on which the latter name is based is preserved in the Queensland Museum (No. 11/176), and, though stuffed and painted silver, leaves no doubt as to its identity with *Therapon puta*.

THERAPON SERVUS Bloch.

Holocentrus servus Bloch, Ausl. Fisch., iv, 1797, pl. cexxxviii, fig. 1.

Grammistes servus Bloch & Schneider, Syst. Ichth., 1801, p. 185.

Therapon servus Günther, Brit. Mus. Cat. Fish., i, 1859, p. 278 (part); Steindachner, Sitzb. Akad. Wiss. Wien, lvi i, 1867, p. 310; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 270; Macleay, Proc. Linn. Soc. N. S. Wales, ii, 1878, p. 348; id., v, 1881, p. 361; Castelnau, Proc. Linn. Soc. N. S. Wales, iii, 1879, p. 350; Ogilby, Cat. Fish. N. S. Wales, 1886, p. 12; Jordan & Thompson, Proc. U. S. Nat. Mus., xli, 1912, p. 536, fig. 1.

Therapon jarbua Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx, 1879, p. 349; Stead, Proc. Linn. Soc. N. S. Wales, xxxi, 1906, p. 174; id., Add. Fish. Faun. N.S.W. (Fish Dept., N.S.W.), 1907, p. 15; Cockerell, Mem. Qld. Mus., ii, 1913, p. 56. (? Not *T. jarbua* Forskal.)

CRESCENT PERCH.

D. xi i 10; A. iii 8-9; P. 13; V. i 5; C. 17. 91-99 scales above the lateral line between its origin and the hypural joint, and 85-95 below it; 14-15 scales between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in 8-10 rows.

Proportions of two specimens 108 and 183 mm. long:—Depth 2.6-2.9 in the length to the hypural joint; head 3.03-3.1 in the same. Eye 3.7-4 in the head, subequal to the length of the snout and the interorbital width, which are 3.7-3.8 and 3.5-4 in the head. Fifth dorsal spine 1.5, first dorsal ray 1.7-2.08, and third anal spine 2.7 in the head.

Body ovate, compressed. Cranium with a few obscure bony ridges posteriorly. Preorbital serrated. Preoperculum denticulate on its hinder and lower margins, with short spines on the rounded angle. Lower opercular spine enlarged, produced beyond the opercular lobe. Suprascapular bone exposed, smooth or serrated; coracoid denticulate. Fifth dorsal spine longest, much higher than the anterior rays; the last spine is much longer than the penultimate one. Second and third anal spines subequal.

Body with three dark longitudinal bands which are curved downward; the first extends from the origin of the spinous dorsal to that of the soft; the second from the nape to the upper surface of the caudal peduncle, and touching the lateral line; the third from the occiput to the middle of the caudal peduncle. The latter extends along the median caudal rays, and there are two oblique bars on either side of it; the upper lobe of the caudal is also tipped with black. A very large black blotch on the spinous dorsal between the fourth and eighth spines, and a small one may be present on the posterior spines; soft dorsal with two black spots.

This diagnosis is based on four Australian specimens, 108-183 mm. long.

Jordan & Thompson (*loc. cit.*) have recorded differences between specimens from various localities of the widely distributed *T. jarbua*, which, they suggest, may represent distinct species. Such material as is available to us bears out their observations, the Australian specimens having smaller and more numerous scales than others from the Philippine Islands and Samoa, but in the absence of a good series from several localities we are unable to add anything to their remarks. As noted by them,

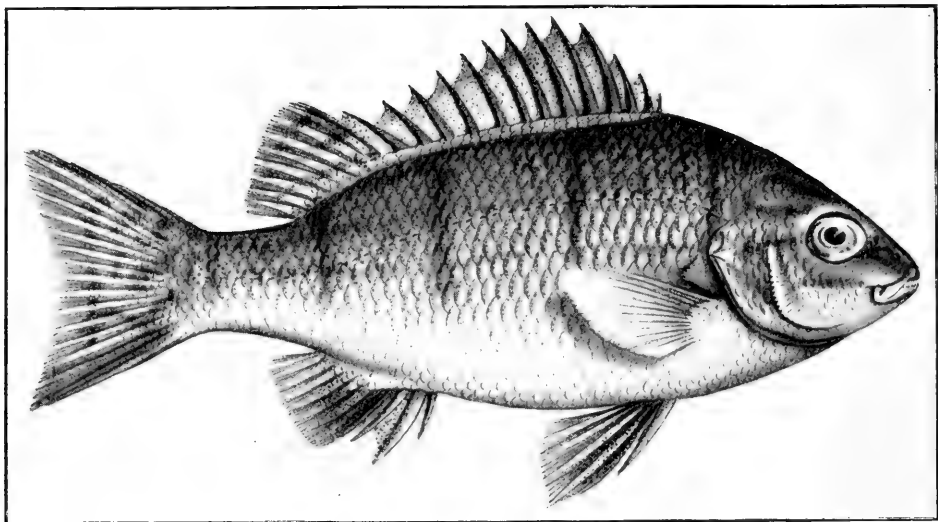


Fig. 1.—THERAPON PERCOIDES Günther. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

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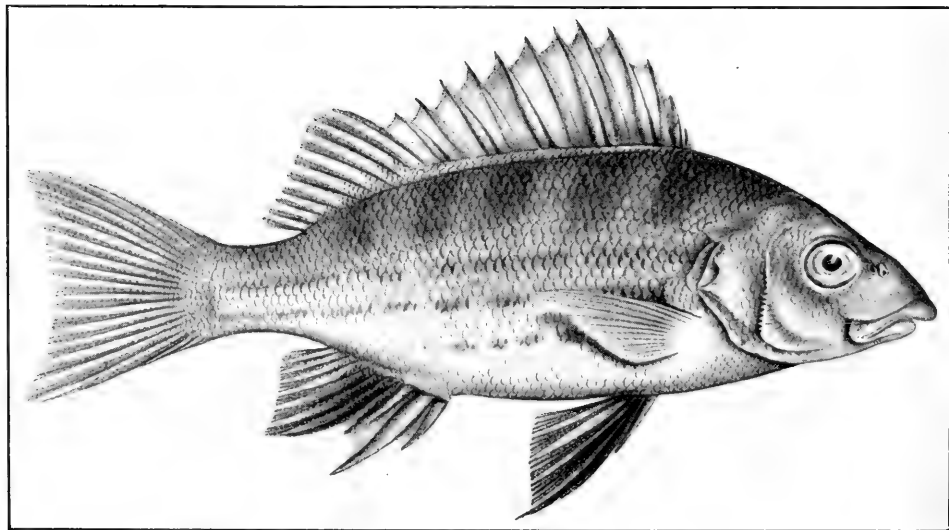


Fig. 2.—THERAPON INTERRUPTUS Macleay. $\frac{2}{3}$ Nat. Size.

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the Australian specimens agree with Japanese examples in their color-marking and scale-counts, and are therefore identical with *T. servus* Bloch, which was originally described from Japan.

Locs.:—Queensland, from north to south; Mapoon, Gulf of Carpentaria; Darnley Island; Edgecumbe Bay; Hervey Bay; Great Sandy Strait; Moreton Bay; Brisbane River; Nerang Creek; Port Darwin, North Australia. Western Australia.

THERAPON PERCOIDES Günther.

Therapon percoides Günther, Ann. & Mag. Nat. Hist. (3) xiv, Nov. 1864, p. 374; id., ibid., xx, 1867, p. 58; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 362; id., ibid., vii, 1882, p. 69; id., ibid., viii, 1883, p. 201; Weber, Zool. Forsch., v, 1893, p. 262; Zietz, Narrat. Horn Exped. Centr. Austr., ii, 1896, Zool., p. 177, pl. xvi, fig. 1; Bancroft, Proc. Roy. Soc. Queensl., xxiii, 1912, p. 255.

Datnia fasciata Steindachner, Sitzb. Akad. Wiss. Wien, lvi, i, 1867, p. 322.

Therapon fasciatus Castelnau, Res. Fish. Aust., 1875, p. 11; id., Proc. Linn. Soc. N. S. Wales, ii, 1878, p. 228; id., ibid., iii, 1878, p. 46; Macleay, ibid., v, p. 363; id., ibid., vii, p. 69; Lucas, Proc. Linn. Soc. N. S. Wales, xix, 1894, p. 362.

Therapon terræ-reginæ Castelnau, ibid., ii, pt. 3, May 1878, p. 227; id., ibid., iii, 1878, p. 46; Macleay, ibid., v, 1881, p. 363; id., ibid., vii, 1882, p. 69.

Therapon spinosior de Vis, Proc. Linn. Soc. N. S. Wales, ix, pt. 2, 19 Aug., 1884, p. 397.

BLACK-STRIPED GRUNTER.

(Plate X, fig. 1.)

Type localities:—Fitzroy River near Rockhampton, M.Q. (*T. percoides*).
Port Jackson, N.S.W., by a mistake (*D. fasciata*).
Swan River, W.A. (*T. fasciatus*).
Fitzroy River, probably (*T. terræ-reginæ*).
Queensland (*T. spinosior*).

Body ovate to subovate, the dorsal contour considerably more arched than the ventral, its width 1.9 to 2.33 in its depth, which is 2.25 to 2.65 in its length and from one fifth to four ninths longer than the head; caudal peduncle usually a little longer than deep, its least depth 7.5 to 8.33 in the body length. Head about two ninths longer than deep, its upper profile linear or feebly rounded to above the posterior third of the eye, beyond which it merges into the occipito-nuchal convexity, its width 1.4 to 2 in its length, which is 3 to 3.33 in that of the body. Snout obtuse and narrowly rounded anteriorly, its length 2.8 to 3.35 in that of the head. Eye large, its diameter from one seventh more to two ninths less than the length of the snout and 1.25 to 1.5 in that of the postorbital head; interorbital region flat or feebly convex, its width 1.1 to 1.5 in the length of the snout. Maxillary not extending to the vertical from the anterior border of the eye. Preorbital strongly denticulated in the young, becoming rugose or even smooth in the adult; preopercle broadly rounded, the angle rather coarsely serrated, the serræ decreasing in size on the hinder limb and disappearing on the lower; opercle with two flat spines, the lower the longer; post-clavicle strongly denticulated; humeral concealed.

Jaws with a band of villiform teeth and an outer series of much enlarged conical approximate movable teeth, the tips of which are recurved; they decrease in size gradually from the front so that some of the posterior ones scarcely exceed or equal the inner teeth; tips of all the teeth chestnut-brown.

Scales in 40 to 42 (37 to 43) series above the lateral line, and 33-39 below it; 6, rarely 7, 1/14 or 15 scales in the series extending obliquely backwards from the base

of the 1st dorsal spine, $4\frac{1}{2}$ -5 between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in 4, rarely 5 series.

Dorsal fin with xiii rarely xiv 9, rarely 8 or 10, rays, originating above the pectoro-ventral interspace, the length of the soft portion 2.5 to 3 in that of the spinous, which is high, the spines rather slender with flexible tips, the first less than a fifth of the 5th, which is the longest, 1.5 to 1.9 in the length of the head; beyond this the spines decrease rapidly to the penultimate, which is shorter than the last; soft dorsal rounded, the anterior rays the longest, a little shorter than its base, and from one sixth to two fifths shorter than the longest spine. Caudal fin emarginate, with the lobes obtusely pointed, the middle rays 4.8 to 5.33 in the body-length. Anal fin with iii 8, rarely 7, rays, the last divided to the base; spines long and strong, the 1st about five ninths of the 2nd, which is stronger and from one tenth to one third longer than the 3rd, 1.5 to 2.1 in the length of the head, and as long as to two ninths more than the longest ray; soft fin similar to but much shorter than the soft dorsal, its length 1.2 to 1.75 in its height. Pectoral obtusely pointed, with 15 rays, the 5th the longest, its length 4 to 4.8 in that of the body. Ventral originating well behind the pectoral base, pointed, the spine long slender and flexible, 1.33 to 1.66 in the fin to the tip of the 1st ray, which is slightly produced, usually somewhat longer than the pectoral, 1.2 to 1.5 in the length of the head, and extending to midway between its origin and the posterior anal rays or further.

Gill-rakers 5 or 6+11 or 12, short and moderately slender, the longest about 4.5 in the eye-diameter.

Upper surface dark blue-gray, gradually shading on the sides into the pearly white of the lower surface, the scales above the lateral line with a darker border, those below darkest basally with an increasingly widening lighter border; back and sides with five black vertical bands two scales wide, the first from the nape to the opercle, the second and third below the spinous dorsal, the fourth below the soft dorsal, and the fifth upon the peduncle. Cheeks and vertical limb of preopercle gray with a faint tinge of yellow, the former with a median horizontal blue bar; lower surface of head white. Spinous dorsal colorless; soft with one or two rows of dusky spots, the basal row always present. Caudal with numerous blue spots on the proximal two thirds and the lower rays uniform dark blue-gray with a narrow white border. Anal clouded, with a broad lighter border. Pectorals colorless, as also are the ventrals, except the middle of the two outer rays which is dusky. (*πέρκη*, perch; *εἶδος*, like.)

The above description has been drawn up after a critical examination of 23 fine examples from various localities. Of these 6 belong to the Old Collection of the Queensland Museum and though faded are in perfect condition; they were presented by Mr. W. N. Jaggard of Rockhampton, by whom they were obtained from the Fitzroy River in the vicinity of that city, and are therefore, practically topotypes of Günther's species. For 10 others we are indebted to Dr. T. L. Baneroff of Eidsvold on the Burnett River, who spared no pains in his endeavour to capture and send them with as little delay as possible; for 3 others from Eureka Creek, Stannary Hills, we have also to thank the same indefatigable collector. The other 4 are preserved in the Australian Museum, and came from the Barron River near Cairns and from the Flinders River at Hughenden and Richmond. The description is therefore based on 17 specimens from rivers flowing towards the east, and 6 from those flowing westwards.

Remarks :—While there can be no doubt that the four names included in the synonymy belong to the same fish, this species, as is the case with so many freshwater forms of wide distribution, shows infinite variation as regards individuals from

different rivers, the inhabitants of one stream having in the course of ages of isolation developed certain small but constant peculiarities, which serve to distinguish them from those of the neighboring watercourses. For instance, the fishes examined from the Upper Burnett differ from those of the Lower Fitzroy as follow, taking the average of all the specimens from either locality :—

Width of body 2 in its depth ; depth of body 2·53, of caudal peduncle, which is longer than deep, 8, of pectoral fin 4·6 in length of body ; length of snout 3, diameter of eye 3·4, width of interorbit 4·14, longest dorsal spine 1·75, longest anal 2 in length of head ; base of soft anal 1·6 in its height Specimens from the Upper Burnett.

Width of body 2·25 in its depth ; depth of body 2·4, of caudal peduncle, which is deeper than long, 7·33, of pectoral fin 4·2 in length of body ; length of snout 3·23, diameter of eye 3·2, width of interorbit 3·85, longest dorsal spine 1·55, longest anal 1·8 in length of head ; base of soft anal 1·35 in its height Specimens from the Lower Fitzroy.

From none of the other rivers have we a sufficiently large series to permit of generalization, but a pair of fine specimens from the Upper Flinders and Eureka Creek show that these northern mountain forms are even thicker and more slender fishes in comparison with those from the Burnett, their proportions, adhering to the sequence given above, being 1·83 ; 2·7, 7·5 (though the peduncle is considerably longer than deep) and 4·3 ; the snout even longer, the eye even smaller, the interorbit even narrower, and the anal spine even lower, the measurements being 2·9, 3·55, 4·42, and 2·12.

Historical.:—This pretty little species was originally described by Günther from “two examples obtained in the Fitzroy River near Rockhampton,” sent to the British Museum by Krefft. Three years later Steindachner, under the name *Datnia fasciata*, described a fish, which was alleged to have come from Port Jackson, and which Günther² identifies with his *Therapon percoides*, adding the comment “This species comes from Queensland and not from Port Jackson.” After a further lapse of eight years Castelnau, quite independently of Steindachner, described as *Therapon fasciatus* a specimen of the same fish from Swan River, W.A. One of Castelnau’s original specimens is preserved in the Australian Museum. It is dried and somewhat damaged, but does not differ in either structure or color-marking from examples of *T. percoides* of the same size from the Burnett River, Queensland. Only another three years had passed when the same author again described Günther’s species as *Therapon terræ-reginæ* from a small example “taken in one of the northern rivers of Queensland, probably the Fitzroy.” In this article he refers to a “Brisbane Museum specimen six inches long from the same river,” and incidentally mentions that he believes that his *T. fasciatus* is “confined to the Western Coast of Australia.” In the following year, however, he claims to have found several of these fishes in “Mr. Gulliver’s collection from the Norman River,” but the characters relied on in that paper are those of a typical *percoides*. Macleay, who considered *fasciatus* to be “a very distinct species,” records it from the Palmer River, a mountain tributary of the Mitchell, on the authority of specimens collected by Tenison-Woods, and remarks that it “seems to be confined to the rivers flowing into the Gulf of Carpentaria,” entirely overlooking the fact that it was originally described from West Australia. Lucas as *T. fasciatus* and Zietz more correctly as *T. percoides* record the species from streams (Palm and Red Bank Creeks) flowing through the McDonnell Ranges, Central Australia, thus bridging over the space between the eastern and western zones of distribution. Lucas is the first writer to use the preorbital and preopercular denticulations as a means of distinguishing *T. fasciatus* from *T. percoides*, but he surely could never have read Günther’s description nor Macleay’s copy of it before committing such a blunder.

² Zool. Rec., iv, 1867, p. 159.

Uses :—This species, which is known as “grunter” among the Burnett anglers, greedily takes any flesh bait in the daytime ; it is a game little fellow, but is usually considered too small for the table, as it rarely exceeds a quarter of a pound in weight, nevertheless the flesh, what there is of it, is equally as good as that of its congeners. (*Bancroft in lit.*)

Dimensions :—Attains a length of 150 millim.

Range :—Although this grunter is principally known as a Queensland species it is probable that it occurs in suitable localities throughout intertropical and juxta-tropical Australia. Within the boundaries of the home State it has been taken in the Burnett River (*Bancroft*), Fitzroy (*Günther*), Barron and Flinders (*Austr. Mus.*), Norman (*Castelnau*), Hodgkinson (*Lucas*), Walsh (*Bancroft*), and Palmer (*Macleay*), while beyond our limits it has been recorded from the McDonnell Ranges (*Zietz*), and Swan River (*Castelnau*).

Illustration :—Our illustration is taken from one of the specimens kindly forwarded to us by Dr. Bancroft.

THERAPON CAUDAVITTATUS Richardson.

Datnia? *caudavittata* Richardson, Voy. Erebus and Terror, Fishes, 1845, p. 24, pl. xviii, fig. 3-5.

Therapon caudovittatus Günther, Cat Fish. Brit. Mus., i, 1859, p. 284; id., Ann. Mag. Nat. Hist. (3) xx, 1867, p. 58; id., Voy. Challenger, Zool., i, 1880, Shore Fishes, p. 39; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 270; Macleay, Proc. Linn. Soc. N. S. Wales, ii, 1878, p. 348; id., ibid., v, 1881, p. 361; Castelnau, Proc. Linn. Soc. N. S. Wales, iii, 1878, pp. 42 and 47; Klunzinger, Sitzb. Akad. Wien, lxxx, i, 1879, p. 350; Waite, Rec. Austr. Mus., iii, 1900, p. 210; McCulloch, Rec. W. Austr. Mus., i, 1912, p. 88.

Therapon caudovittatus vel bostockii Castelnau, Proc. Zool. Soc. Viet., ii, 1873, p. 128.

D. xiii 8-9; A. iii 8; P. 14-15; V. i 5; C. 17. 52-56 series of scales above the lateral line between its origin and the hypural joint, and 44-49 below it; 6-7½ scales between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in 9-10 rows.

Proportions of a specimen 196 mm. long :—Depth 2.8 in the length to the hypural joint; head 3.3 in the same. Eye equal to the interorbital width, 4.5 in the head and 1.6 in the snout. Snout 2.7 in the head. Fifth dorsal spine 1.8, anterior dorsal ray 2.1, and second anal spine 2.5 in the head.

Body compressed, the dorsal profile a little more arched than the ventral. Interorbital ridges well developed, those of the cranium weak. Maxillary reaching to below the nostrils or the anterior orbital margin. Preorbital more or less serrated. Preoperculum evenly and finely serrated. Lower opercular spine well developed, not or scarcely projecting beyond the opercular lobe. Suprascapular hidden beneath the skin and scales; coracoid denticulate. Fifth dorsal spine longest, higher than the rays; the last spine is shorter than the penultimate one. Second anal spine longer than the third.

Color in formaline :—Violet grey on the back, lighter on the sides, and white below; the upper parts and the sides are closely spotted with round greyish spots. Dorsal fin similarly spotted, the soft portion with a blackish margin. Caudal more or less spotted basally, each lobe with a large black blotch extending obliquely across it.

We have a good series of specimens 127-196 mm. long which exhibit very little variation.

Locs. :—Fremantle, Western Australia; Torres Strait; Murray Island, Torres Strait; Gulf of Papua; Dutch New Guinea.

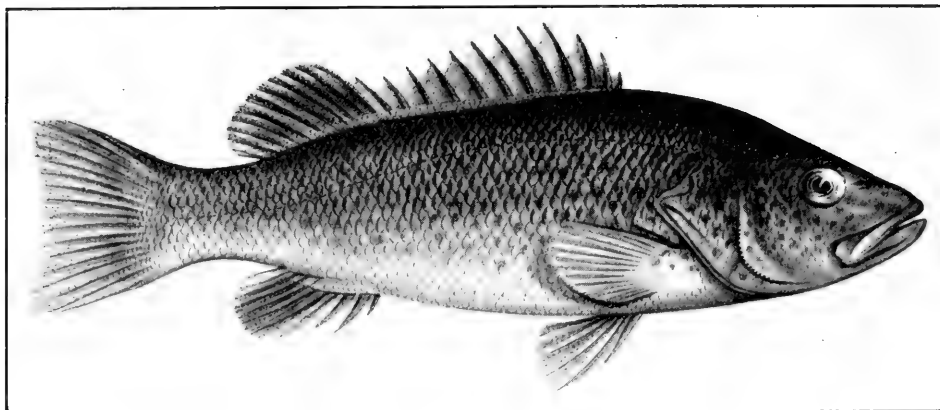


Fig. 1.—THERAPON UNICLOR Günther. $\frac{2}{3}$ Nat. Size.

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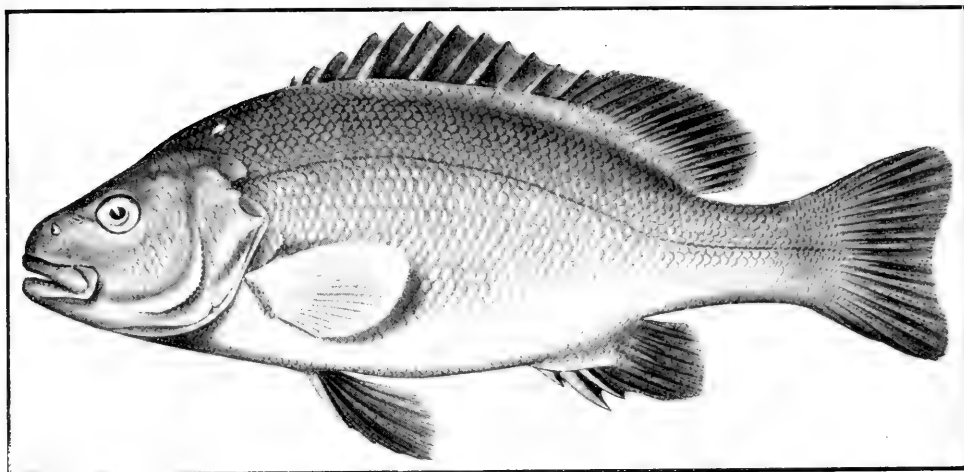


Fig. 2.—THERAPON BANCROFTI Ogilby & McCulloch. $\frac{1}{2}$ Nat. Size.

A. R. McCulloch, del.

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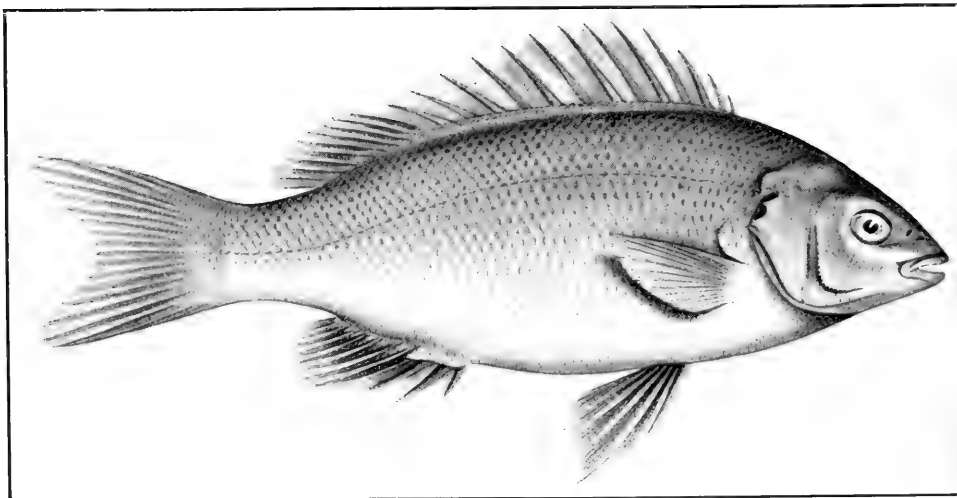


Fig. 3.—THERAPON PARVICEPS Macleay. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

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Distribution :—This species has been recorded from the following localities :—Western Australia ; Harvey River (*Richardson*) ; Fremantle (*Castelnau, Waite, and McCulloch*). North Australia : Port Essington (*Günther*) ; Port Darwin (*Macleay*). Queensland : Somerset and Cape York (*Günther*) ; Norman River, Gulf of Carpentaria (*Castelnau*) ; Port Denison (*Klunzinger*). Torres Strait (*Macleay*). Murray Island (*McCulloch*). Darnley Island (*Tosh*) ; Gulf of Papua (*Macleay*). Moreton Bay (*Queensland Museum, O.C.*)

THERAPON UNICOLOR Günther.

(Plate XI, fig. 1.)

Therapon unicolor Günther, Brit. Mus. Catal. Fish., i, 1859, p. 277 ; Macleay, Proc. Linn. Soc. N. S. Wales, iii, 1878, p. 15 ; Günther, Zool. Challenger, i, 1880, Shore Fish., p. 32 ; Macleay, *ibid.*, v., 1881, p. 266 (*after Günther*) ; Woods, Fish and Fisher. N. S. Wales, 1882, p. 15 ; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 11 ; Stead, Proc. Linn. Soc. N. S. Wales, xxxiv, 1909, p. 116.

? *Datnia brevispinis* Steindachner, Sitzb. Akad. Wiss. Wien, lvi, i, 1867, p. 309.³

Therapon truttaceus Macleay, *ibid.*, v, pt. 3, Feb., 1881, p. 366 ; Zietz, Zool. Horn Exped., ii, 1896, p. 176.

Therapon longulus Macleay, *ibid.*, p. 367.

Therapon elphinstonensis, de Vis, Proc. Roy. Soc. Queensl., i, May, 1885, p. 57.

Therapon unicola Kent, Great Barrier Reef, 1893, p. 369.

Therapon unicolor Waite, Synops. Fish. N. S. Wales, 1904, p. 33.

Therapon idoneus Ogilby, Proc. Roy. Soc. Queensl., xx, 15 Oct., 1907, p. 37.

Therapon truttaceus Waite, Trans. Roy. Soc. S. Austr., xxxviii, 1914, p. 446.

SPANGLED GRUNTER.

Type localities :—Gwydir River N.S.W. (*T. unicolor*).

Endeavour River, N.Q. (*T. truttaceus*).

Freshwaters inland from Port Darwin, N.T. (*T. longulus*).

Lake Elphinstone, M.Q. (*T. elphinstonensis*).

Upper Condamine River, S.Q. (*T. idoneus*).

Body elliptical or elongate-elliptical, the dorsal and ventral contours symmetrical or the former a little more arched, its width 1.5 to 1.9 in its depth, which is 2.75 to 3.5 in its length and from one twelfth more to one fourth less than the length of the head ; caudal peduncle as long as to two fifths longer than deep, its least depth 7.5 to 10 in the body-length. Head about four ninths longer than deep, its upper profile linear or feebly concave, that of the nape gently rounded, its width 1.5 to 2 in its length, which is 2.7 to 3.2 in the body-length. Snout broadly rounded, its length 3.1 to 3.66 in the length of the head ; lips moderate. Eye rather small, its diameter 1.15 to 1.75 in the length of the snout and 2 to 2.6 in the postorbital head ; interorbital region flat or feebly convex, its width 1.25 to 1.66 in the length of the snout. Maxillary extending to the vertical from the anterior border of the eye or even to that of the pupil. Preorbital entire or with a few coarse denticles posteriorly ; hinder limb of preopercle serrated, the serræ disappearing on the broadly rounded angle ; opercle with a short, stout pungent spine, above which is a more or less blunt point ; post-clavicle with some coarse denticles.

Jaws with a broad band of villiform teeth and an outer series of enlarged fixed teeth, which are separate and somewhat recurved ; roof of mouth toothless.

³ *Datnia brevispinis* Steindachner has been briefly described from Cape York. Such characters as are given agree with those of *Therapon unicolor* Günther, with which Steindachner's species is probably identical.

Scales in 48 to 56 series above, 44 to 52 below the lateral line ; 8 or 9/1/18 to 21 scales in the series extending obliquely backwards from the base of the first dorsal fin ; cheek-scales in 8 or 9 series below the middle of the eye. Lateral line tubes 46 to 51.

Dorsal fin with xii (rarely xi or xiii) 10 (rarely 9 or 11) rays, originating above the pectoro-ventral interspace, the length of the soft portion 2 to 2.25 (1.9 to 2.4) in that of the spinous, which is low, with the spines rather weak and flexible, the 1st short, about one third of the 5th, which is usually a little longer than the 4th or 6th, its length 2.85 to 3.4 in that of the head ; beyond these the spines are finely graded to the penultimate, which is about one sixth shorter than the last ; soft dorsal rounded, the 2nd and 3rd rays longest, 1 to 1.25 in its base and one fifth to two fifths more than the longest ray. Caudal fin truncate or feebly emarginate with the angles rounded, the middle rays 5 to 5.6 (4.75 to 6) in the body-length. Anal with iii 8, sometimes 7 or 9, rays, the last divided to the base ; spines short and stout, the 2nd or 3rd longest, 3 to 4 in the length of the head and 1.3 to 1.7 in the longest ray ; soft fin similar to but much shorter and usually a little higher than the soft dorsal, its length 1.3 to 1.7 in its height. Pectoral rounded, with 15, rarely 14 sometimes 16, rays, its length 5 to 5.6 in that of the body. Ventral fin originating well behind the pectoral base, rounded, the spine short and flexible, less than half the length of the 2nd ray, which is usually longer than the pectoral, 1.5 to 2 in the length of the head, and extending to midway between its origin and the 1st anal spine or 2nd ray.⁴

Gill-rakers 5 or 6+11 or 12, short and stout, the longest 3 to 3.33 in the eye-diameter.

Blue-gray, each scale with a dark brown or purplish border, which almost, or in large examples wholly, conceals the ground color above the lateral line, but grows gradually narrower and fainter down the sides, where each scale has a central golden or bronzy spot, and finally merges in the ground color, which itself passes insensibly into the white or yellowish white of the lower surface. Soft dorsal brown with a paler marginal band ; anal spines and anterior ray and usually the lower caudal rays white, the other fins colorless. (*unicolor*, of one color. A most unfortunate name for this handsome fish.)

In the preparation of the above description we have examined 64 picked specimens from the following localities :—Burnett River at Eidsvold collected by Dr. T. Bancroft (14) ; Fitzroy River at Rockhampton, Mr. W. N. Jaggard (10) ; Inkerman (1) and Cromarty (3) both in the Townsville District ; Lake Elphinstone, Dr. Ling Roth (3), types of *T. elphinstonensis* ; Eureka Creek, Stannary Hills, Dr. T. Bancroft (12) ; Norman River at Normanton, Dr. C. Taylor (2) ; Gregory River, Dr. T. Bancroft (3) ; Alice River at Barcaldine (10) ; Lagunes in Ryan's Paddock near Goondiwindi, Mr. J. Lamb (4) ; and Condamine River, Messrs. M. Colclough (1) and Mr. White (1), the latter being the type of *T. idoneus*.

Remarks :—Although, as might be expected in a freshwater fish inhabiting so vast a territory, and living under so many and diverse conditions, the individual variation is very great, we have not found that these differences are confined to certain fixed areas, but occur indiscriminately wherever the species exists.

⁴ An analysis of the fin variation in the 64 examples critically examined gives the following results :—

D. xi 10 (1) ; xii 9 (4) ; xii 10 (47) ; xii 11 (10) ; xiii 11 (2).

A. iii 7 (9) ; iii 8 (43) ; iii 9 (12).

P. 14 (1) ; 15 (52) ; 16 (11).

Historical:—This handsome grunter was first described by the late Dr. Albert Günther, more than half a century ago, from specimens sent to the British Museum from the "Head of Mosquito Creek near Darling Downs"—a South Queensland locality which we have failed to identify—and the Gwydir River, N.S.W. These specimens, as is always the case when they have been for some time in a preservative, had lost their distinctive color-markings, and become "grayish, each scale with a darker margin"; consequently they were encumbered with the inappropriate name by which they are now known. Some twenty years later Macleay identified certain small fishes, forwarded to him from a recently filled dam at Warialda, in the Gwydir District, as belonging to this species, and accounted for their presence in an outlying dam, "which had been dry a few months back," on the hypothesis that the ova had been conveyed from more permanent waterholes "adhering to the feathers of ducks or other aquatic birds." We think that the size of these fishes, given as "about four inches," militates against this theory, for such fishes are of slow growth and could hardly attain to such a length in so short a time and in such a limited space. We are more inclined to believe it to be an ordinary case of suspended animation in individuals, which had buried themselves in the mud when the water in the dam had sunk so low as to leave them exposed to their many enemies. In his Report on the Shore Fishes of the Challenger Expedition Günther made an important addition to its distribution, being able to record it from the "River Mary near the village of Tiaro," thus bringing it across to the eastern slope of the Dividing Range. In 1881 Macleay in his Catalogue, while adding nothing to the known distribution of *T. unicolor*, described as new two more species of freshwater *Therapon* under the names *T. truttaceus* and *T. longulus*,⁵ the former from the Endeavour River, N.Q., the latter from "freshwaters inland from Port Darwin," N.T. Both of these we believe to be inseparable from Günther's fish. *T. truttaceus* was subsequently recorded by Zietz from specimens obtained by the Horn Expedition in Red Bank Creek, Finke River, Palm Creek, and Walker's Gorge, and some years later Waite endorsed Zietz's identification from the examination of specimens collected in the same district by Mr. S. A. White's expedition into the interior. About four years after the publication of Macleay's new species de Vis received from Dr. Ling Roth some small fishes which he had obtained in Lake Elphinstone, a turgid sheet of water, some six miles long by two wide, lying landlocked between the watersheds of the Nebo and Suttor Rivers, inland from Mackay, M.Q. These he considered to be undescribed, and named them after their place of origin, stating, however, that they were nearly allied to *T. longulus* Macleay. An examination of the types shows no characters of sufficient value to separate them from *T. unicolor*. Finally the senior author, having received from Mr. D. O'Connor a fine *Therapon*, collected by Mr. White in the Upper Condamine, described it as *T. idoneus*, while noting its relationship to Macleay's and de Vis' species above referred to. He also gave an interesting account of the way in which these fishes sometimes appear by myriads in creeks where they were previously unknown, and after remaining for some time disappear with the same suddenness as marked their advent.

Some years ago Stead exhibited before the Linnean Society of New South Wales certain fishes, which were said to have come up through an artesian bore from a depth of 943 feet at Corella, in North-Western New South Wales. These he identified with *T. unicolor*. It was remarked that in most of these specimens the eye was damaged, or in some cases entirely absent, and from this circumstance the opinion was expressed that the fishes did not live and breed in the subterranean waters, but had individually found their way thither.

⁵ We have examined the type of *T. truttaceus* which is preserved in the Macleay Museum. The typical specimen of *T. longulus* appears to have gone astray.

The protrusion of the eyeball in fishes, a disease commonly known as "Pop-eye," has formed the subject of a very valuable paper by Professor C. Coleridge Farr.⁶ His investigations, which were based on the eggs and young of trout in the Canterbury artesian water system, practically proved that the eyes protruded as a result of excessive gas contained in the water, and he expressed the opinion that the effect was identical with that observed in the Corella bore fishes. Under these circumstances, we see no reason to accept Mr. Stead's suggestion that these fish came up the bore, but assume that they were merely aestivating somewhere in its vicinity, and upon being again vivified by the bore water, came under the influence of its contained gases and so developed pop-eye.

Uses.—Though rather small for general table use this species attains a weight of half a pound, and is of good flavor as a pan-fish, while with a light rod and the finest tackle it gives fair sport, fighting gamely for its life when hooked.

Range.—This fish is very widely distributed throughout subtropical and tropical Australia, being found practically everywhere from lat. 30° S. northward to Cape York and westward to at least the upper waters of the Murchison, whence the late Mr. Alexander Morton brought two small specimens many years ago. Specimens are in the Australian Museum from King Sound, North-Western Australia, which were collected by Mr. J. Cairn in 1886.

Illustration.—Our figure is taken from a fine specimen collected by Dr. Thomas Bancroft at Eidsvold on the Burnett.

Therapon bidyana Mitchell.

SILVER PERCH.

Acerina (Cernua) bidyana Mitchell, Three Exped. Int. Eastern Austr., i, 1838, p. 95, pl. viii.

Datnia elliptica Richardson, Zool. Erebus and Terror, Ichth., 1848, p. 118, pl. lii, fig. 4-8.

Therapon ellipticus Günther, Brit. Mus. Cat. Fish., i, 1859, p. 276; Klunzinger, Arch. für Naturg., xxxviii, i, 1872, p. 21; id., Sitzb. Akad. Wiss. Wien, lxxx, i, p. 350; Castelnau, Proc. Zool. Soc. Viet., ii, 1873, p. 127; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 363; Ogilby, Ed. Fish. N. S. Wales, 1893, p. 28, pl. vi; Waite, Rec. Austr. Mus., iii, 1900, p. 210.

Therapon ellipticus Waite, Mem. N. S. Wales Nat. Club, No. 2, 1904, p. 33; Stead, Ed. Fish. N. S. Wales, 1908, p. 73, pl. xlii.

Therapon niger Castelnau, Proc. Zool. Soc. Viet., i, 1872, p. 59; id., ibid., ii, 1873, p. 38; Macleay, ibid., p. 365; id., ibid., ix, 1884, p. 12; Ogilby, Cat. Fish. N. S. Wales, 1886, p. 11; Lucas, Proc. Roy. Soc. Viet. (2), ii, 1890, p. 19.

Therapon richardsoni Castelnau, Proc. Zool. Soc. Viet., i, 1872, p. 60; Macleay, ibid., p. 364; Ramsay, Proc. Linn. Soc. N. S. Wales, vi, 1882, p. 832; Ogilby, ibid., p. 11; Lucas, ibid.; Kent, "Gt. Barrier Reef," 1893, pp. 282, 369.

Therapon macleayana Ramsay, Proc. Linn. Soc. N. S. Wales, vi, 1882, p. 831; Macleay, ibid., ix, 1884, p. 12; Ogilby, ibid., p. 12.

Therapon bidyana McCulloch, Rec. Austr. Mus., ix, 1913, p. 359; id., Proc. Linn. Soc. N. S. Wales, xl, 1915, p. 262, pl. xxxvi, fig. 1.

D. xii 12-13; A. iii 8-9; P. 17; V. i 5; C. 17. 75-89 scales between the origin of the lateral line and the hypural joint counted below the lateral line, and 82-92 above it; 13-14 between the lateral line and the middle of the spinous dorsal. Cheek-scales in 8-10 rows.

⁶ Coleridge, Rept. 13th Meeting Austr. Assn. Adv. Sci., 1911 (1912), p. 354.

Depth 3·3-2 in the length to the hypural joint ; head 3·3-3·5 in the same. Eye 4·5-4·6 in the head, 1·3 in the snout, which is 3·4 in the head. Sixth dorsal spine 1·8, first dorsal ray 2·2-2, second anal spine 1·6-2·1, and pectoral fin 1·6 in the head.

Body slender in the young, deeper in adults. Head rather small. Snout obtusely pointed, jaws equal. Maxillary almost reaching to below the anterior margin of the eye, its hinder portion exposed. Eye of moderate size, shorter than the snout ; interorbital space nearly flat, with feebly developed bony ridges ; its width is a little greater than the length of the snout. Nostrils about their own diameter apart, with raised skinny margins, the anterior with a small lobe. Preorbital strongly serrated. Preoperculum with rather strong teeth which are largest on the rounded angle. Two flat opercular spines, each of which is often double ; the lower is the larger, not reaching beyond the opercular lobe. Scapula and suprascapula denticulate.

Each jaw with a row of cardiform, partly depressible teeth externally, followed by a band of villiform ones. Vomer toothless, the skin surrounding it with a number of minute papillæ which resemble teeth but which are soft and free from the bone. Scales slightly enlarged on the anterior portion of the side, very small on the breast. They form the usual sheaths at the bases of the dorsal and anal spines, and extend up between the bases of the dorsal, anal, pectoral, and caudal rays.

Dorsal spines long and moderately strong, the fifth and sixth highest, and longer than the rays ; last spine not longer than the penultimate : rays decreasing evenly backwards, the posterior margin of the soft dorsal rounded. Second anal spine longer than the third, as long as or a little longer than the anterior rays ; margin of the soft anal obliquely truncate. Fifth upper pectoral ray longest, the hinder margin of the fin rounded. Ventrals inserted below the third or fourth dorsal spine, the anterior ray with a short filament, and reaching the vent in smaller specimens or not so far in larger ones. Caudal deeply emarginate.

Silvery, upper surfaces finely dotted with brown, each scale with a darker margin.

Described from four specimens, 199-282 mm. long. The young of this species differs greatly from the adult in being elongate, and in having the snout convex. It has been recently figured by McCulloch (*loc. cit.*), while the adult is illustrated by Stead (*loc. cit.*).

We are indebted to Mr. H. K. Anderson, of the Fisheries Department of New South Wales, for the following interesting notes on the habits and breeding of *T. bidyana* :—

“ The Silver Perch is one of the most plentiful and important fishes of the western waters of New South Wales, and occurs in large numbers in the Murray River and many of its tributaries. It inhabits clear running waters, and prefers to feed in the vicinity of eddies, breaking the surface like trout in quest of flies and other insects, borne along by the current. It usually attains a weight of five pounds, although much larger specimens have been taken. The Silver Perch is a good sporting fish, and were it better known to anglers, many who now confine themselves exclusively to trout-fishing, would spend some of their time in its quest. It is not generally known that Silver Perch will come readily to a trout-fly or a small spinner, though a whole shoal may be caught with one if the fisherman keeps out of sight and does not frighten them by causing an undue disturbance of the water. Nor must he let a hooked fish escape, or the whole shoal will immediately disappear, and may not show themselves again for a considerable time. I recently caught five fish, weighing from three pounds down to half a pound, from one shoal in half an hour on small

"cochy-y-bondhu," and had excellent sport. They fought a rushing battle, and did not give in until practically dead. When playing in the water, or when freshly caught, Silver Perch frequently make a snorting sound which has earned for them the vernacular name 'Grunter.'

"At spawning time, Silver Perch congregate in deep water under high banks, selecting a spot dimpled with eddies, where they usually remain within a few feet of the surface. Their eggs are demersal, and adhere to submerged roots and rushes, etc. In November, 1914, while sitting quietly on a bank near Darlington Point on the Murrumbidgee River, chance rewarded me with some little insight into their breeding-habits. A shoal of between fifty and seventy Silver Perch was playing in a series of eddies under a precipitous bank where the water was perhaps ten or twelve feet deep. Some were feeding at the surface, while others swam about, apparently aimlessly; a section of the shoal, comprising most of the larger fish, remained in a central position. It being well known that the majority of the larger fish of any species are females I assumed those in the centre to be spawning females, while the smaller fish swimming around them were ripe males. Suddenly, as though preconcerted, all the fish swam rapidly to the centre, splashing the water in all directions, and becoming hidden for an instant by its disturbed surface. Next moment the water around and below them assumed a white opaque tinge, as though a bucket of milk had been thrown in; this was clearly due to the extrusion of the milt of the male fishes. This operation was repeated five or six times at intervals of about twenty or thirty minutes while I watched, but soon after sundown the fish disappeared."

THERAPON HUMERALIS Ogilby.

Therapon humeralis Ogilby, Proc. Linn. Soc. N. S. Wales, xxiv, 1899, p. 177; Waite, Rec. Austr. Mus., vi, 1905, p. 62, pl. ix.

D. xii-xiii 11; A. iii 10. Between eighty and ninety series of scales between the origin of the lateral line and the hypural joint, and fourteen to fifteen between the lateral line and the middle of the spinous dorsal. Depth 2.8-2.9 in the length to the hypural; head 3.3 in the same. Eye a little shorter than the snout, 3.7-3.8 in the head. Longest dorsal spine much longer than the rays, 1.6-1.7 in the head; the last shorter than the penultimate. Second anal spine a little longer than the third, but shorter than the anterior rays.

Upper surface of cranium with prominent ridges. Lower preopercular spine enlarged, but not projecting beyond the opercular lobe. Preoperculum armed with strong spines which are enlarged at the angle. Teeth in a band in each jaw, the outer row enlarged, conical, not cardiform; vomer and palatines toothless. Gill-rakers moderately elongate and numerous.

A broad dark shoulder-spot. Body with four dark cross-bars, the first incomplete, below the anterior dorsal spines, and the last on the caudal peduncle. Some dark bars and spots below and behind the eye. Soft dorsal, anal, and caudal fins with dark spots.

Loc.:—Houtmans Abrolhos, Western Australia; marine.

THERAPON (DATNIA) INTERRUPTUS Macleay.

(Plate X, fig. 2.)

Therapon interruptus Macleay, Proc. Linn. Soc. N. S. Wales, viii, 1883, p. 258.

TAPIROID GRUNTER.

D. xii 10; A. iii 8; V. i 5; P. 1-13; C. 17. 51-52 series of scales between the origin of the lateral line and the hypural joint counted below the lateral line, and 54-55 above it; 6-7½ between the lateral line and the middle of the spinous dorsal.

Depth 2·8-3 in the length to the hypural joint; head 2·8-2·9 in the same. Eye a little larger than the interorbital width, 3·9-4·1 in the head and 1·4-1·5 in the snout; snout 2·7 in the head. Fifth dorsal spine 1·6-1·8, anterior dorsal ray 1·8-2, second anal spine 1·7, and anterior anal ray 1·4-1·5 in the head.

Body compressed. Snout acute, the upper lip produced into a fleshy point; upper jaw overhanging the lower, which closes behind the premaxillaries. Maxillary extending backward to below the end of the first third or fourth of the eye; it is entirely covered by the posterior lobe of the upper lip. Eyes large. Nostrils close together, the anterior with a skinny lobe. Preorbital with a few small teeth posteriorly. Hinder margin of the preoperculum with moderately strong teeth which are largest above the rounded angle; lower margin entire. Operculum with two spines, the lower strong but not overlapping the opercular lobe. Teeth in a band in each jaw, the outer ones enlarged, cylindrical, and movable. Vomer either toothless or with about three median teeth; palatines toothless. Gill-rakers of the first gill-arch rather long and slender posteriorly, about sixteen on the lower limb.

Scales arranged as usual in the genus. They are larger on the anterior portion of the side, becoming smaller on the back, belly, and tail, and minute before the ventrals. There are about thirteen series on the cheeks, the lower ones being very small.

Dorsal spines strong, the fifth longest, and longer than the rays; the last is shorter than the penultimate one: soft dorsal a little emarginate. Anal fin originating behind the vertical of the last dorsal spine, and terminating in advance of the soft dorsal: the second spine is very long and strong, a little shorter than the anterior rays, and much longer than the third spine; soft anal pointed anteriorly. Pectoral pointed, the second upper ray longest. Ventral inserted below the fourth dorsal spine, the anterior ray with a short filament, reaching beyond the vent.

Silvery, with three longitudinal dark bands on each side below the lateral line which are more or less broken up into elongate blotches. Back with five broad dark cross-bands which run obliquely downward and backward. Fins without markings.

Described from two of Macleay's typical specimens, 171-182 mm. long. They differ from his description in several details, particularly in the proportions of the eyes, interorbital space, and snout, while the dorsal markings are oblique instead of vertical. They are allied to *Datnia argentea* Cuvier & Valenciennes.

Loc. :—Normanby Island, D'Entrecasteaux Group; fresh water.

THERAPON (DATNIA) ARGENTEUS Cuvier & Valenciennes.

Datnia argentea Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 139, pl. liv; Day, Fish. India, 1875, p. 71, pl. xviii, fig. 7.

Mesopristes macracanthus Bleeker, Nat. Gen. Arch. Ned. Ind., i, 1844, p. 523.

Datnia cancellatoides Bleeker, Nat. Tijdschr. Ned. Ind., iv, 1853, p. 247.

Therapon argenteus Günther, Brit. Mus. Cat. Fish., i, 1859, p. 283.

Therapon (Datnia) argenteus Bleeker, Atlas Ichth., vii, 1876, p. 114. pls. ccxxvi, fig. 1, and ccxxxix, fig. 4.

Therapon nasutus Macleay, Proc. Linn. Soc. N. S. Wales, vii, 1882, p. 258.

Therapon chalybeus Macleay, ibid., p. 259.

Therapon acutirostris de Vis, Proc. Linn. Soc. N. S. Wales, ix, 1884, p. 398.

D. xii 10; A. iii 8-9; P. 13-14; V. i 5; C. 17. 52-55 series of scales below the lateral line between its origin and the hypural joint, and 55-58 above it; $6\frac{1}{2}$ -8 scales between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in 8-9 rows.

Proportions of two specimens 122 and 262 mm. long. Depth 2.6-2.7 in the length to the hypural joint; head 2.7 in the same. Eye 3.3-4.3 in the head, shorter than the snout, and greater than the interorbital width. Snout 2.5-2.8, interorbital space 4.8-5.2 in the head. Fifth dorsal spine 1.4-1.7, first dorsal ray 1.6-1.7, second anal spine 1.4-1.9, and first anal ray 1.5 in the head.

Body elevated, compressed. Snout sharply pointed, the upper jaw the longer; the profile from its tip to the first dorsal spine is almost straight or slightly convex on the nape. Interorbital and cranial ridges well developed in the young, obsolete in adults. Preorbital bone serrated. Preoperculum more or less denticulate, the denticles enlarged on the rounded angle in young specimens. Lower opercular spine not produced beyond the opercular lobe. Suprascapular and coracoid bones exposed and more or less denticulate. Dorsal and anal spines very long and strong. The fifth dorsal spine is the longest, much longer than the rays in the young, subequal to them in adults; eleventh and twelfth spines subequal, or the last slightly the longer; soft dorsal rounded. Second anal spine longer than the third, as long as the rays in the young, shorter in adults; soft anal angular.

Color in alcohol:—Uniform dusky silver; the fin-membranes are somewhat darker, the anterior and posterior anal rays white. In the young there are three narrow longitudinal dark bars on the sides.

The above diagnosis is based on eight specimens 105-262 mm. long from various localities.

Remarks:—The typical specimens of *Therapon nasutus* Macleay are in the Australian Museum collection; they do not differ from the descriptions and illustrations of *T. argenteus* quoted above. *Therapon chalybeus* was also based on a young example of Cuvier and Valenciennes' species: the typical specimen, which is preserved in the Australian Museum, proves the proportions given by Macleay to be incorrect in several details. A young specimen from Queensland, received by the Australian Museum from the Queensland Museum in 1886, agrees very well with de Vis' description of his *T. acutirostris*, and is possibly a co-type of that species; it is also identical with *T. argenteus*.

Locs.:—We have examined specimens from the following localities:—Port Moresby, Papua; Normanby Island, D'Entrecasteaux Group, in fresh water; Santo and Eromanga, New Hebrides; Queensland.

THERAPON CARBO sp. nov.

(Plate XII, fig. 1.)

ROUND-TAILED GRUNTER.

Type locality:—Gregory River, N.Q.

Body ovate, the dorsal contour scarcely more arched than the ventral, its width 2 to 2.1 in its depth, which is 2.3 to 2.4 in its length and one fourth more than the length of the head; caudal peduncle deeper than long, its least depth 7.25 to 7.33 in the body-length. Head about one fourth longer than deep, its upper profile linear to above the hinder border of the eye, beyond which it merges into the occipitonasal convexity, its width 1.67 in its length, which is 2.85 to 3 in that of the head. Snout rather sharp and narrowly rounded in front, its length 3 to 3.15 in that of the head; lips rather thin. Eye moderate, its diameter 1.33 to 1.5 in the snout and 2 to 2.2 in the postorbital head; interorbital region feebly convex, its width but little less than the length of the snout. Maxillary extending to below the posterior nostril.

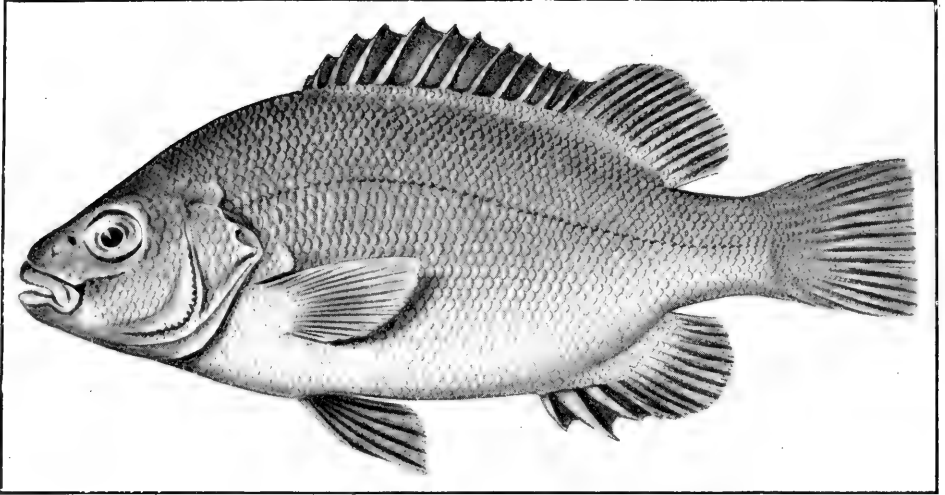


Fig. 1.—THERAPON CARBO Ogilby & McCulloch. $\frac{5}{8}$ Nat. Size.

A. R. McCulloch, del.

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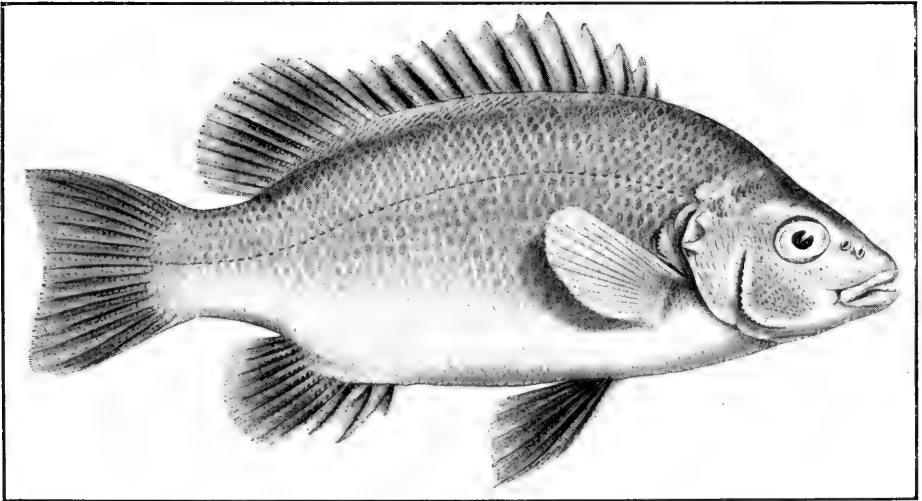


Fig. 2.—THERAPON FULIGINOSUS Macleay. $\frac{5}{9}$ Nat. Size.

A. R. McCulloch, del.

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Preorbital entire; vertical limb of preopercle coarsely serrated, the serræ gradually decreasing on the rounded angle and disappearing on the lower limb; opercle with two spines, the lower the longer; post-clavicle with a few coarse denticles; humeral entire.

Teeth as in *T. unicolor*.

Scales in 63 series above, 58 below the lateral line; transverse series from below origin of dorsal 10/1/23; cheek-scales in 7 series. Lateral line tubes 56.

Dorsal fin with xii 13 or 14 rays, originating above the pectoral-base, the length of the soft portion 1.6 to 1.75 in that of the spinous, which is low, with the spines strong and pungent, the 1st very short, less than a fourth of the 5th and 6th, which are the longest, 2.5 to 2.67 in the length of the head; beyond these they are finely graded to the last, which is nearly as long as the 3rd and 1.3 in the longest spine; soft dorsal rounded, the antero-median spines the longest, 1.3 in its base, and from one tenth to two sevenths more than the longest spines. Caudal fin rounded, the middle rays 4.8 to 5 in the body-length. Anal fin with iii 11 or 12 rays, originating below the last dorsal spine; spines short and stout, curved, the 1st 1.67 in the 2nd, which is stronger and a little longer than the 3rd, 2.65 to 2.75 in the length of the head, and 1.15 to 1.33 in the longest ray; soft fin similar to but much shorter and a little higher than the soft dorsal, its base as long as or a little shorter than its height. Pectoral obtusely pointed, with 16 rays, the 6th the longest, 4.6 to 4.85 in the body-length. Ventral inserted behind the pectoral base, pointed, the spine moderate and rather short, 1.67 to 1.8 in the fin to the tip of the outer ray, which is slightly produced, a little shorter than the pectoral, 1.65 to 1.8 in the length of the head, and extending to midway between its origin and the 3rd anal ray.

Gill-rakers 5+11, rather short and stout, the longest about one third of the eye-diameter.

Uniform blackish. (*carbo*, a lump of coal.)

Described from two specimens, measuring respectively 150 and 182 millim., collected by Dr. Bancroft in the upper waters of the Gregory River, District of Carpentaria.

Regarding this fish Dr. Bancroft writes—"I found this black fish at Gregory Plains, south-west of Burketown, where it is common; when fishing for it I found that it behaved in exactly the same manner as I have already described the Eureka Creek fish as doing (*see* p. 120). It is a fine game fish, growing to a weight of four pounds and over, and is of excellent quality for the table."

Illustration :—Our figure is taken from the smaller of the two examples mentioned above. Reg. No. I. 15/2445.

THERAPON FULIGINOSUS Macleay.

(Plate XII, fig. 2.)

Therapon fuliginosus Macleay, Proc. Linn. Soc. N. S. Wales, viii, pt. 2, 17 July, 1883, p. 201.

SOOTY GRUNTER.

Type locality :—Upper Burdekin River, N.Q.

D. xii 13; A. iii 9-10; P. 15-16; V. i 5; C. 17. Between the origin of the lateral line and the hypural joint, there are 46-50 series of scales counted below the

lateral line, and 51-58 above it; 9-10 scales between the lateral line and the middle of the spinous dorsal. Cheek-scales in about 8 or 9 rows, the lower ones very small.

Proportions of two specimens 126 and 210 mm. long:—Depth 2.6 in the length to the hypural joint; head 2.9-3.1 in the same. Eye 4.4-5 in the head, and 1.3-1.4 in the snout, which is 3.1 in the head. Sixth dorsal spine 2.1-2.4, median dorsal rays 1.7-2, second anal spine 2.5-2.7, and third anal ray 1.8-1.9 in the head.

Body somewhat elevated, compressed. Snout obtusely pointed, the upper profile of the head almost straight in the young, concave in adults; it is distinctly arched from the nape to the origin of the dorsal fin. Interorbital space almost flat, without bony ridges. Jaws equal. Maxillary reaching almost to the anterior orbital border or to below the first fourth of the eye; its posterior portion exposed. Eye of moderate size, shorter than the snout; its length is a little greater than the interorbital width in young specimens, and less than it in adults. Nostrils separated by a space which is a little wider than their own diameter, with free skinny margins, the anterior with a distinct lobe. Preorbital bone obscurely denticulate in the young, entire in adults. Preoperculum evenly denticulate, the denticles largest above the rounded angle. Operculum with two flat spines, the lower the larger, but not reaching beyond the opercular lobe. Suprascapular and coracoid bones exposed and more or less denticulate.

Each jaw with a band of teeth, the outer series of which is enlarged, cylindrical, and acute. Palate toothless. Gill-rakers well developed and rather slender, about sixteen on the lower limb of the first arch. Scales largest on the anterior portions of the sides, very small on the breast. They form the usual sheaths at the bases of the dorsal and anal spines, and extend up between the bases of the dorsal, anal, and caudal rays.

Dorsal spines moderately strong, the sixth the longest, almost as long as the median rays in young specimens, but much shorter than them in adults; the last spine is not longer than the penultimate one: soft dorsal rounded, its median rays longest. Second anal spine stronger, and a little longer than the third, but much shorter than the anterior rays: soft anal either rounded or a little angular. Pectoral somewhat rounded, the fifth upper ray longest. Ventrals inserted below the third or fourth dorsal spine, almost or quite reaching the vent. Caudal emarginate.

Uniform dark purplish brown, each scale with a lighter margin. Soft dorsal and anal with a wide greyish border; pectorals grey with a more or less distinct dark bar across the base; tips of ventral rays translucent grey.

Described from six specimens 126-327 mm. long, of which five are Macleay's original specimens, from the Upper Burdekin River. The other is 210 mm. long, and was taken in the upper waters of the Burdekin River: it is figured on Plate XII. Macleay's description is evidently based on the larger examples, and his proportions consequently differ slightly from those given above. In a specimen 327 mm. long the depth is just one third of the total length or 2.5 in the length to the hypural joint; the eye is but little more than half as long as the snout, as he describes it.

Remarks:—Macleay remarked that this species was "a thick heavy fish, attaining a length of 15 inches, and seemingly abundant." We may assume that in its habits and qualities as a food-fish it does not differ materially from its relatives.

THERAPON BANCROFTI sp. nov.

(Plate XI, fig. 2.)

PURPLE GRUNTER.*Type locality* :—Eureka Creek, Stannary Hills, N.Q.

Body subovate, the dorsal and ventral contours sub-symmetrical in the young, the former more strongly arched in the adult, its width 1.67 to 1.85 in its depth, which is 2.67 to 2.8 in its length and equal to one sixth more than the length of the head; caudal peduncle a little longer than deep, its least depth 7.4 to 7.8 in the body-length. Head about three tenths longer than deep, its upper profile linear or feebly concave to above the middle of the eye, beyond which it merges into the occipitono-chal convexity, imperceptibly in the young but with a decided protuberance in the adult, its width 1.6 to 1.8 in its length, which is 2.75 to 3.15 in that of the body. Snout obtuse and broadly rounded anteriorly, its length 2.55 to 2.85 in that of the head; lips thick and fleshy. Eye small, its diameter 1.8 to 1.9 in the length of the snout and 2 to 2.4 in the postorbital head; interorbital region convex, its width 1.33 to 1.67 in the length of the snout. Maxillary not extending to the vertical from the anterior border of the eye. Preorbital entire or with a few coarse denticles posteriorly; preopercle broadly rounded, the vertical limb and angle with coarse serræ, which become blunted with age; opercle with two spines, the lower the longer; post-clavicle and humeral bones rugose.

Jaws with a broad band of villiform teeth and an outer series of strong conical approximate teeth, the extremities of which are slightly recurved; tips of all the teeth golden bronze.

Scales in 57 to 61 series above, in 51 to 55 below the lateral line; 11/1/20 or 21 scales in the series extending obliquely backwards from the base of the 1st dorsal spine: cheek-scales small, in 8 irregular series below the middle of the eye. Lateral line tubes 50 or 51.

Dorsal fin with xii 12 or 13 rays, originating above or a little behind the lower angle of the pectoral base, the length of the soft portion 1.5 to 1.6 in that of the spinous, which is low, with the spines rather slender but pungent, the 1st very short, less than a fourth of the 5th and 6th, which are the longest, 2.75 to 3.1 in the length of the head; beyond these the spines are finely graded to the penultimate, which is a trifle shorter than the last; soft dorsal obtusely pointed, the posterior middle rays the longest, 1.25 to 1.5 in its base, and from two fifths to three fifths more than the longest spines. Caudal fin emarginate with the angles rounded, the middle rays 5 to 5.35 in the body-length. Anal fin with iii 8, sometimes 9, rays, the last divided to the base; spines short and stout, the 1st about five ninths of the 2nd, which is stronger and a little longer than the 3rd, 3 to 3.2 in the length of the head, and 1.55 to 1.7 in the longest ray; soft fin similar to but much shorter and a little higher than the soft dorsal, its length 1.5 to 1.65 in its height. Pectoral obtusely pointed, with 16 rays, the 5th the longest, its length 4.6 to 4.85 in that of the body. Ventral originating well behind the pectoral base, rounded, the spine short and stout, less than half of the fin to the tip of the 2nd ray, which is a little longer than the 1st, as long as or a little shorter than the pectoral, 1.6 to 1.8 in the length of the head, and extending to midway between its origin and the 4th anal ray or less.

Gill-rakers 7+17, well developed and rather slender, the longest about 2.25 in the eye-diameter.

Upper surface of head and trunk and entire tail dark purplish brown, becoming lighter on the sides of the trunk, where many of the scales develop a lavender-gray

central spot, which increases in size and intensity towards the abdomen; throat and abdomen pale brown, uniform or with large bluish white blotches, which are irregular in shape and position. Sides of head brown; edge of upper lip, lower lip, and intermandibular space livid white or, in the case of the latter, light brown. Unpaired fins blackish, the tips of the posterior dorsal and anal rays and the outer half of the caudal shading to lavender; pectorals and outer half of ventrals gray. (Named after Dr. Thomas Lang Bancroft, to whose researches in many branches of natural science Queensland is much indebted.)

Described from 4 specimens, measuring between 205 and 260 millim., collected by Dr. T. L. Bancroft in Eureka Creek, a feeder of the Walsh River (itself a tributary of the Mitchell) in the Stannary Hills mining district of York Peninsula. One of these belongs to the Amateur Fishermen's Association of Queensland, by which it was kindly lent to us for comparison with the specimens in the State Museum.

Our knowledge of this fish has been derived entirely from notes kindly communicated by Dr. Bancroft. He states that it is common in Eureka Creek and is known in that district as the "Black Bream"; that it grows to fully a pound and a half in weight, is a strong and plucky fighter, and is of excellent quality as a table fish. That it is also a fish of considerable cunning and quite competent to take care of itself appears from the following extract:—"When fishing for it I have always noticed that it is easy to catch the first fish, but that you will hardly ever get another in the same place. Directly you drop the bait in a deep rocky pool it is seized, and when drawing up your struggling victim others of the school accompany it to the surface. After that none of the fishes in that pool will look at your bait, so you have just got to move away to the next suitable spot."

Illustration :—Taken from a fine example, 248 millim. long, now on exhibit in the Queensland Museum. Reg. No. I. 15/2318.

THERAPON TRIMACULATUS Macleay.

(Plate XIII, fig. 1.)

Therapon trimaculatus Macleay, Proc. Linn. Soc. N. S. Wales, viii, pt. 2, 17 July, 1883, p. 258.

BANDED GRUNTER.

Type locality :—Goldie River, B.N.G.

D. xiii 11-13; A. iii 10-11; 46-50 series of scales between the origin of the lateral line and the hypural joint counted below the lateral line, and 47-54 above it; $6\frac{1}{2}$ - $7\frac{1}{2}$ between the lateral line and the middle of the spinous dorsal. Cheek-scales in 6-7 rows.

Depth 2.2-2.5 in the length to the hypural joint; head 2.9 in the same. Eye 1.1-1.4 in the snout, and 3.7-4.6 in the head; snout 2.8-3.7 in the head. Fifth dorsal spine 2, second dorsal ray 1.5-1.6, and second anal spine 2.6-2.8 in the head.

Body deep, compressed. Snout obtusely pointed, the upper profile almost straight to the nape where it is convex; interorbital space almost flat, the bony ridges of the upper surface of the head but feebly developed. Jaws equal. Maxillary reaching back to behind the vertical of the posterior nostril, or to below the anterior portion of the eye; its posterior portion exposed. Eyes not very large, equal to the snout in young specimens, smaller in adults; the interorbital width is slightly less than the length of the snout. Nostrils well separated, the anterior small and tubular, the other larger. Preorbital entire or with some small teeth posteriorly. Operculum with

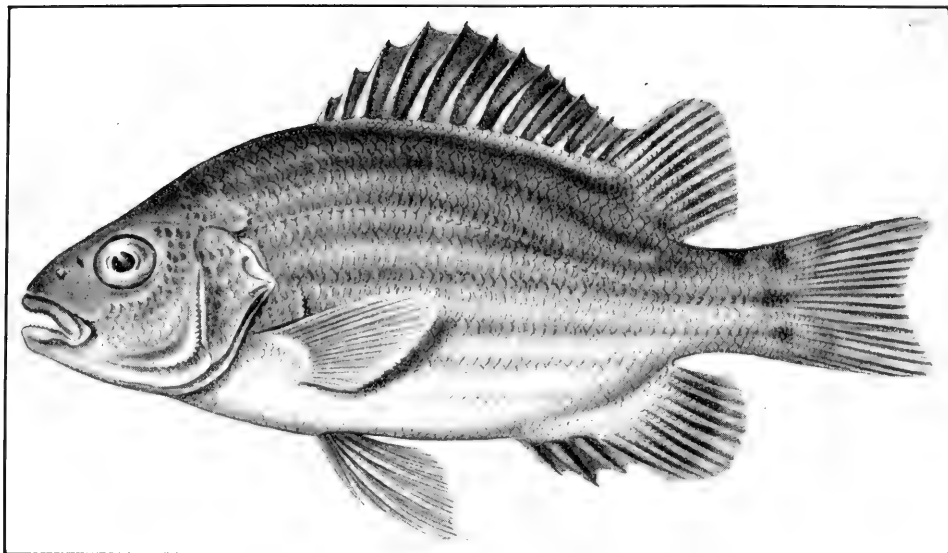


Fig. 1.—THERAPON TRIMACULATUS Macleay. $\frac{5}{8}$ Nat. Size.

A. R. McCulloch, del.

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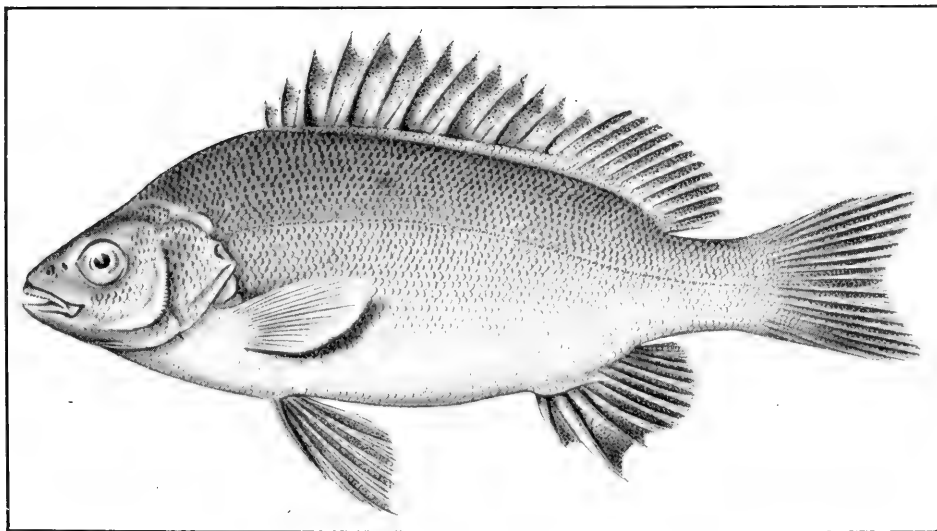


Fig. 2.—THERAPON HILLII Castelnau, imm. $\frac{2}{3}$ Nat. Size.

A. R. McCulloch, del.

Page 121.

two spines, the lower strong, but not extending beyond the opercular lobe. Teeth in a band in each jaw, the outer ones largest, cylindrical, and fixed; vomer and palatines toothless. Gill-rakers of the first gill-arch rather short and thick posteriorly, about twelve on the lower limb.

Scales largest on the anterior portion of the sides, smallest on the caudal peduncle and anterior to the ventrals.

Dorsal spines moderately strong, the fifth the longest but shorter than the anterior rays; last spine a little shorter than the penultimate one: soft dorsal rounded. Anal originating below the posterior dorsal spines and terminating slightly in advance of the soft dorsal: the spines are rather strong, the second a little longer than the third, and much shorter than the rays; soft anal rounded. Pectoral pointed above, the hinder margin rounded; fourth or fifth upper ray longest. Ventrals inserted below the origin of the dorsal in the young, farther back in adults, and reaching back to the vent or to the anal fin; anterior ray with a short filament. Caudal emarginate.

The color-markings are indistinct in most of the specimens, and are clearly shown in only one small example. This has eight rather broad dark bands on either side, those above the lateral line following the curve of the back and being more or less confluent posteriorly, while those below it are horizontal. The median band terminates in a dark mark on the base of the caudal, above and below which are two dark rounded spots; another spot on the upper margin of the caudal peduncle. Some specimens have the outer portions of the dorsal and anal fins light-colored, while the membranes of the spinous dorsal and anal bear darker markings. There is a light curved band at the base of the pectoral, and the opercular membrane is blackish posteriorly.

Described from three specimens, 94-200 mm. long, the largest and smallest being two of the typical specimens, and the other a Queensland example. The figure is prepared from the latter, but the color-marking is copied from one of Macleay's smaller specimens.

Loc.:—Goldie River, New Guinea; fresh water. York Peninsula, Queensland; this locality is uncertain and requires verification.

THERAPON HILLII Castelnau.

(Plate XIII, fig. 2.)

Therapon hillii Castelnau, Proc. Linn. Soc. N. S. Wales, ii, pt. 3, May, 1878, p. 226.

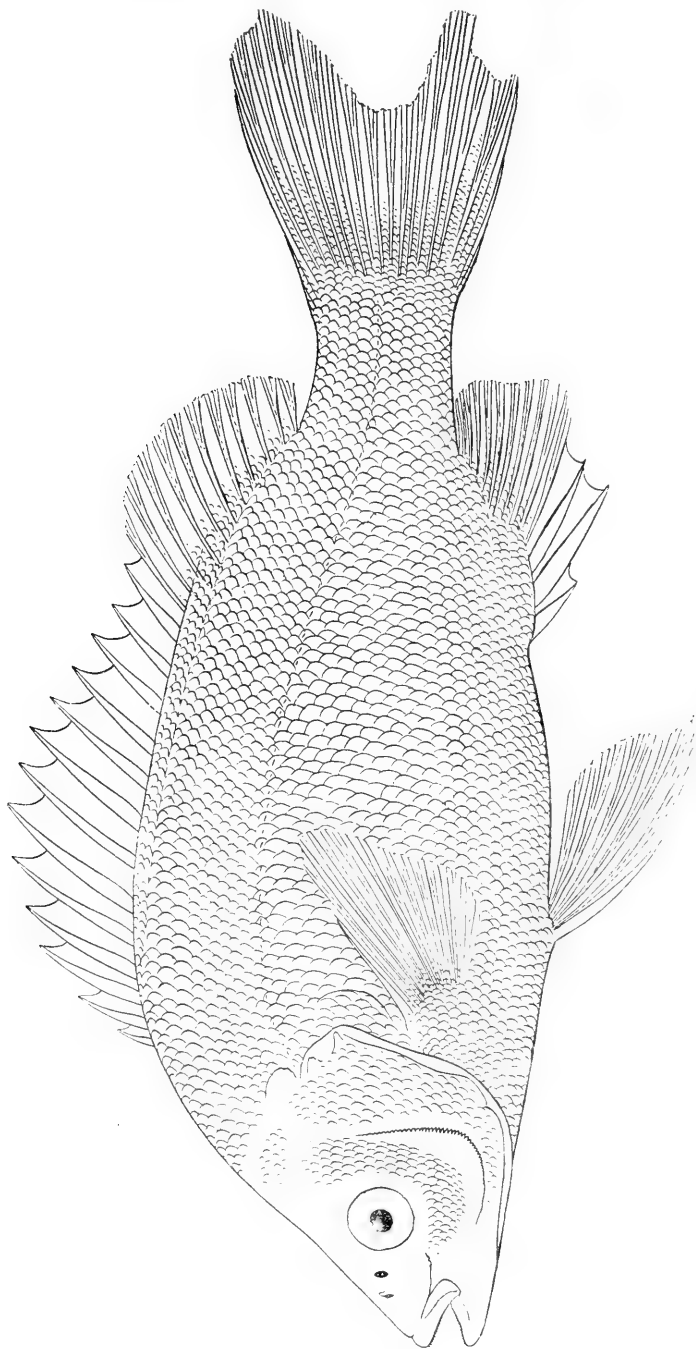
LEATHERY GRUNTER.

Type locality:—Upper Dawson River at Taroom.

D. xiii 11-12; A. iii 9-10; V. i 5; P. 15-17; C. 17. 59-67 series of scales between the origin of the lateral line and the hypural joint counted below the lateral line, and 63-71 above it; 10-11½ between the lateral line and the middle of the spinous dorsal. Cheek-scales in about six rows.

Depth 2.2-2.8 in the length to the hypural joint; head 3.1-3.2 in the same. Eye 4.5-5.1 in the head, and 1.2-1.5 in the snout, which is 3.2-3.7 in the head. Interorbital width 3.3-3.5, depth of caudal peduncle 2.4-2.5 in the head. Sixth dorsal spine 1.7-1.8, second dorsal ray 2.1, second anal spine 1.8-2.2; and second anal ray 1.6-1.9 in the head. Pectoral fin 1.4, first ventral ray 1.3 in the head.

Body moderately deep, compressed. Head small, its upper profile rising very obliquely from the snout to the dorsal fin, straight or a little convex on the nuchal region. Interorbital space flat or slightly convex. Snout obtusely pointed, jaws



Text-figure 1.—*THERAPON HILLII* Castelnau, ad. $\frac{3}{4}$ Nat. Size.
A specimen 272 mm. long, from Zamia Creek, Dawson River, Queensland.
A. R. McCulloch, del.

equal. Maxillary reaching to below the posterior nostril or the anterior margin of the eye; its hinder portion exposed. Eyes of moderate size, shorter than the snout; the interorbital width is equal to or a little greater than the length of the snout. Nostrils about their own diameter apart, the anterior with a skinny lobe. Preorbital bone serrated in the young, almost entire in a larger specimen. Preoperculum evenly denticulate posteriorly, the teeth being slightly enlarged on the rounded angle. Two flat opercular spines, the lower the larger, but not produced beyond the opercular lobe. Suprascapular exposed, and together with the coracoid, denticulate in the young, almost entire in adults.

Each jaw with a row of cardiform, somewhat flattened teeth which are partly depressible; they are followed by a broad band of villiform teeth. The vomer in a large specimen appears to have borne teeth which have decayed away; of three smaller examples, one has a single median tooth on the vomer, while the others have the palate quite smooth: a number of minute dermal papillæ project from the skin surrounding the vomer which resemble teeth, but they are quite soft and free from the bone. Gill-rakers rather long and slender on the lower limb of the first arch. Scales largest on the middle of the sides, smaller on the abdomen and breast. They form the usual sheaths at the bases of the dorsal and anal spines, and extend up between the bases of the dorsal, anal, caudal, and pectoral rays.

Dorsal spines long and strong, the sixth the highest and longer than the rays; the last spine is not longer than the penultimate one: soft dorsal rounded posteriorly. Second anal spine much longer than the third in young specimens and longer than the rays; it is shorter in adults: soft anal rounded in the young, the anterior portion somewhat angular in larger specimens. Fifth upper pectoral ray longest, the hinder margin of the fin rounded. Ventrals inserted below the origin of the dorsal in the young, and not nearly reaching the vent; in the adult they are placed farther back and extend almost to the anal fin. Caudal emarginate.

Olive or greyish green on the back and sides, becoming lighter below; irregular blackish spots or blotches may be present on the body, which are not bilaterally symmetrical. The membranes of all the fins except the pectorals are uniformly dusky.

Described from four specimens, 138, 141, 232, and 272 mm. long. The text-figure represents the largest example, while that of 141 mm. is figured on Plate XIII.

This species varies considerably in form, some specimens being much deeper than others; none of our examples are so slender as described by Castelnau, and it seems probable that his statement that the height is contained three times in the length *without* the caudal should be substituted by *with* the caudal. He has described "a transverse line of teeth on the palate," but this character is not present in any of our specimens; though a patch of vomerine teeth is present in some of the marine species of *Therapon*, at least in their younger stages, the palate appears to be almost or entirely smooth in all the Australian freshwater species. The proportions of the anal spines are variable with age, they being relatively longer in the young than in adults.

Locs.:—Zamia Creek, Dawson River; Gylanda, Dawson River; Norman River.

Remarks:—Dr. Bancroft writes that this fish is uneatable; no matter how long it may be boiled it retains the consistency of shoe-leather; hence the local name of "leatherjacket" at Gylanda.

THERAPON PARVICEPS Macleay.

(Plate XI, fig. 3.)

Therapon parviceps Macleay, Proc. Linn. Soc. N. S. Wales, viii, pt. 2, 17 July, 1883, p. 201.**SMALL-HEADED GRUNTER.***Type locality* :—Upper Burdekin River, N.Q.

D. xiii 10-11 ; A. iii 9 ; P. 15 ; V. i 5 ; C. 17. 49-56 series of scales below the lateral line between its origin and the hypural joint, and 51-51 above it ; 8-10 scales between the lateral line and the middle of the spinous dorsal fin. Cheek-scales in 5-6 rows.

Proportions of two specimens 95 and 207 mm. long :—Depth 2.8-2.9 in the length to the hypural joint ; head 3.3-5 in the same. Eye 3.7-5 in the head, and 1.07-1.5 in the snout, which is 3.3-3.4 in the head. Interorbital width 2.9-3.2 in the head. Sixth dorsal spine 1.8-2, first dorsal ray 1.8-2, third anal spine 2.2-2.3, and first anal ray 1.6-1.7 in the head. Pectoral fin 1.4-1.5, and anterior ventral ray 1.2-1.4 in the head.

Body ovate, compressed, the upper and lower profiles either almost evenly arched, or the ventral line somewhat flattened. Snout obtusely pointed, the profile from its tip to the first dorsal spine forming a very slightly convex arch. Interorbital space a little convex, smooth ; a few bony ridges on the hinder part of the cranium. Upper jaw slightly longer than the lower ; maxillary reaching to below the posterior nostril or almost to the vertical of the anterior orbital margin, its distal end exposed. Eye rather small, shorter than the snout in adults and much narrower than the interorbital space. Nostrils separated by a space which is a little greater than their own diameter ; both have free skinny margins which are subdivided into lobes. Preorbital bone obscurely denticulate in the young, entire in adults. Preoperculum evenly denticulate, the denticles somewhat enlarged on the rounded angle. Operculum with two spines, the lower of which is the longer but is not produced beyond the opercular lobe. Suprascapular and coracoid bones exposed and more or less denticulate.

Each jaw with a band of minute teeth, the outer series of which is the largest and subcardiform ; the outer surfaces of the teeth are flattened, and they are partly depressible. Vomer and palatines toothless in adults ; a single median vomerine tooth is rarely present in the young. Scales largest on the anterior portions of the sides, smaller on the breast.

Dorsal spines rather slender, the sixth the longest and equal in length to the anterior ray ; the last spine is not longer than the penultimate one : soft dorsal slightly rounded, its anterior rays longest. Second and third anal spines subequal in length, but much shorter than the anterior rays : margin of the soft anal obliquely truncate or slightly rounded. Pectoral pointed above, the fifth upper ray longest. Ventrals inserted below the fourth or fifth dorsal spine and reaching almost or quite to the vent. Caudal deeply emarginate.

Brownish grey on the back, becoming silvery on the sides ; the base of each scale of the upper parts with a small dark spot. A silver band from the upper lip to the lower orbital margin. Fin-membranes more or less dusky, the soft dorsal, anal, and caudal with lighter margins.

Described from six of Macleay's original specimens, 95-207 mm. long, the largest of which is the type of the species and is figured on Plate

This species is nearest to *T. hillii* Castelnau, but is distinguished by its larger and less numerous scales.

Loc. :—Upper Burdekin River, Queensland.

PELATES Cuvier & Valenciennes.

Pelates Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 145 (*quadrilineatus*).

This genus is well differentiated from *Therapon* by having the gill-membranes united to the isthmus. The teeth are flattened, and arranged in three rows on the upper jaw and in two on the lower.

Key to the Australian Species of Pelates.

- a*¹. A large black blotch on the dorsal fin between the third and eighth spines; a dark shoulder-mark usually present *quadrilineatus*.
*a*². Dorsal fin without a black blotch; no dark shoulder-mark *sexlineatus*.

PELATES QUADRILINEATUS Bloch.

- Holocentrus quadrilineatus* Bloch, Ausl. Fisch., iv, 1797, p. 63, pl. cccxxviii, fig. 2.
Therapon quadrilineatus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 134; Günther, Brit. Mus. Cat. Fish., i, 1859, p. 282; Day, Fish. Ind., 1878, p. 70, pl. xviii, fig. 5.
Therapon xanthurus Cuvier & Valenciennes, *ibid.*, p. 135.
Helotes polytaenia Bleeker, Nat. Tijdschr. Ned. Ind., vi, 1854, p. 53; *id.*, Atl. Ichth., vii, 1876, pl. cccxii, fig. 2.
Therapon cuvieri Bleeker, Nat. Tijdschr. Ned. Ind., vi, 1854, p. 211; *id.*, Atl. Ichth., vii, 1876, pl. cccxv, fig. 2; Günther, *ibid.*, part.; Macleay, Proc. Linn. Soc. N. S. Wales, ii, 1878, p. 348.
Therapon (Pelates) quadrilineatus Bleeker, Atlas Ichth., vii, 1876, p. 117.

This species is recorded from Port Darwin by Günther and Macleay.

PELATES SEXLINEATUS Quoy and Gaimard.

- Pristipoma sexlineatum* Quoy & Gaimard, Voy. Uranie, Zool. 1824, p. 320.
Pelates quadrilineatus Cuvier & Valenciennes, Hist. Nat. Poiss., iii, 1829, p. 146, pl. Iv. (Not *Holocentrus quadrilineatus* Bloch.)
Pelates sexlineatus Cuvier & Valenciennes, *ibid.*, p. 147 (Port Jackson specimen); Valenciennes, Illustr. Poiss. Règne Anim., 1843, pl. xii, p. 148.
Pelates quinquelineatus Cuvier & Valenciennes, *ibid.*, p. 148.
Therapon cuvieri part. Günther, Brit. Mus. Cat. Fish., i, 1859, p. 282; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 362.
Therapon cuvieri Castelnau, Proc. Linn. Soc. N. S. Wales, ii, 1879, p. 350; Ogilby, Cat. Fish. N. S. Wales, 1883, p. 11; Waite, Mem. Austr. Mus., iv, 1, 1899, p. 81; Fowler, Proc. Acad. N. Sci. Philad., 1907 (1908), p. 433. (Not *T. cuvieri* Bleeker.)
Therapon quadrilineatus Ogilby, Ed. Fish. N. S. Wales, 1893, p. 26; Waite, Mem. N. S. Wales Nat. Club, ii, 1904, p. 33; Stead, Ed. Fish. N. S. Wales, 1908, p. 73. (Not *Holocentrus quadrilineatus* Bloch.)
Therapon sexlineatus Steindachner, Sitzb. Akad. Wiss. Wien, liii, 1866, p. 429.

P. sexlineatus is very similar to *P. quadrilineatus* Bloch in all structural details, but appears to differ constantly in lacking the dark shoulder-mark and the black blotch on the dorsal fin which is characteristic of that species. It is so far known only from Eastern Australia. Specimens are in the Australian Museum from near Sydney, and Queensland.

EXPLANATION OF PLATES.

PLATE X.

- Fig. 1.—*Therapon percoides* Günther. A specimen 143 mm. long, from Queensland.
Fig. 2.—*Therapon (Datnia) interruptus* Macleay. Type, 182 mm. long, from Normanby Island, D'Entrecasteaux Group.

PLATE XI.

- Fig. 1.—*Therapon unicolor* Günther. A specimen 190 mm. long, from Eidsvold, Burnett River, Queensland.
Fig. 2.—*Therapon bancrofti* sp. nov. Type, 248 mm. long, from Eureka Creek, Stannary Hills District, Queensland.
Fig. 3.—*Therapon parviceps* Macleay. Type, 207 mm. long, from the Upper Burdekin River, Queensland.

PLATE XII.

- Fig. 1.—*Therapon carbo* sp. nov. Type, 150 mm. long, from the Upper Gregory River, Queensland.
Fig. 2.—*Therapon fuliginosus* Macleay. A specimen 210 mm. long, from the Upper Burdekin River, Queensland.

PLATE XIII.

- Fig. 1.—*Therapon trimaculatus* Macleay. A specimen 149 mm. long, supposed to have been obtained in the York Peninsula, Queensland. The color-marking is copied from one of the typical specimens from the Golde River, New Guinea.
Fig. 2.—*Therapon hulli* Castelnau. A young specimen 141 mm. long, from the Norman River, Queensland.

EDIBLE FISHES OF QUEENSLAND.

PART IV.—SYNENTOGNATHI (No. 1).

SUBORDER I.—SCOMBRESOCOIDEA.

BY J. DOUGLAS OGILBY (ICHTHYOLOGIST).

(Plates XIV to XXIII.)

“Synentognaths with small scales and with the mouth typically large, the jaws usually produced and narrowed forwards; rami of the lower jaw united by the interlocking of a series of inner processes (except in *Cololabis*); maxillaries firmly united to premaxillaries. Third upper pharyngeals moderately enlarged; fourth usually present; lower pharyngeal triangular or long and narrow. Pharyngeal teeth usually villiform or granular, some of the teeth of the principal plates often compressed, tricuspid. Parasphenoid without apophysis; myodome elongate, the parasphenoid and pro-otic meeting in a long sutural union; auditory bulla, if distinct, little prominent, with but a shallow depression in front of it. Posttemporal more or less expanded and laminar, simple or with a small inner fork; supraclithrum small, partly or entirely hidden by the posttemporal; cleithrum connected with basioccipital by a strong ligament. Each pelvic bone of an anterior subtriangular lamina and an erect laminar process, which is more or less expanded superiorly.” (*Regan.*)¹

Key to the Scombresocoid Families.

α^1 . Both jaws produced, furnished with bands of small teeth.

b^1 . Jaw with an additional series of more or less enlarged erect conical pointed teeth; no finlets i. BELONIDÆ.

b^2 . Jaws without enlarged teeth; finlets present SCOMBRESOCOIDEÆ.

FAMILY I.—BELONIDÆ.

Scombresocoidæ part. Günther, Brit. Mus. Catal. Fish., vi, 1866, pp. 234-256; Day, Fish. India, pt. 3, 1877, pp. 509-512; Boulenger, Cambridge Nat. Hist., vii, 1904, p. 637.

Mastacembeliformes Bleeker, Atlas Ichth., vi, pt. 2, 1871, p. 43.

Esocidæ Gill, Proc. U. S. Nat. Mus., xviii, 1895, p. 177; Jordan & Evermann, Fish. North & Mid Amer., pt. i, 1896, p. 708.

Belonidæ Jordan and Starks, Proc. U. S. Nat. Mus., xxvi, 1903, p. 526; Regan, Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 331.

“THE NEEDLE-FISHES.”

Body usually much elongated, covered with small flaky scales. Cleft of mouth wide. Both jaws produced to form a stout pointed beak, armed with bands of small sharp teeth and a single series of strong widely set erect conical

¹ Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 331.

teeth; vomerine teeth rarely present. Anterior dorsal and anal rays forming a lobe (except in *Potamorhaphis*); no dorsal or anal finlets. Posttemporal forked, the upper fork more or less expanded, anteriorly attached to the nearly horizontal epiotic and pterotic lamina, the lower fork short and slender, attached to a process of the exoccipital lamina; supracleithrum small, vertical, more or less concealed beneath the posttemporal. Vertebrae 57 to 77; precaudals with strong parapophyses to which the ribs are attached.

Carnivorous synentognaths inhabiting all warm seas; many of the species enter rivers and a few live permanently in fresh water. Six genera, with about 60 species, are now recognized. Of these, two—*Tylosurus* and *Athlennes*—have already been recorded from our waters; species of *Belone* occur from the East Coast of Africa and North-West Australia through the South Sea Islands to Hawaii and can not, therefore, be overlooked; *Xenentodon* rests at present on Macleay's statement² "235. *Belone cancella* Buch. 'Quarrabudda' of the natives. From fresh water [at Port Moresby or Cuppa Cuppa]." I am inclined to doubt the correctness of the identification of this Indo-Burmese fish so far east. Several species of needle-fishes (better known to our fishing community by the vernacular name "long tom") frequent our seas, while others doubtless occur on our northern borders as evidenced by their recorded distribution. [They are carnivorous and predacious, feeding at or near the surface, wandering in small companies or singly along the shore, and rarely venturing to any great distance from the land. Like all fishes of similar habits, whose strenuous mode of existence demands great and continuous muscular exertion, they require a large amount of nourishment to replace the loss occasioned by their active life, and sustain in unabated vigor the energy on which such excessive calls are made; it is not surprising, therefore, that we find them extremely swift in movement and insatiable in appetite. They are consequently very destructive to small or young surface-swimming fishes, of which they destroy vast numbers in excess of those which they actually consume. They delight in throwing themselves high into the air, and frequently skim along the surface of the water for a considerable distance with marvelous velocity. Such, indeed, is their reckless impetuosity that, in the case of the larger and weightier species, serious accidents, resulting even in death, have been caused to bathers from the impact of the dagger-like beak on the unprotected body. Their partiality for leaping over any small floating object, which may attract their attention, is another peculiar habit common to these volatile fishes; in some countries this habit is ingeniously made use of for their capture, by the simple means of a wooden framework, which somewhat loosely supports a piece of fine netting. They may also be taken by hook and line from a moving boat in a strong tideway, so long as the lure, for which any small shining object will suffice, is kept near the surface. All the species are of good quality for the table, and though often rejected because of the greenish color of their bones, this is natural and has no deleterious significance. The ova, which are large and consequently few in number, float on the surface when first shed; each ovum, however, is provided with several series of silky filaments, and is enabled, by means of these delicately barbed processes, to attach itself to any suitable object. When the little fish first emerges from the egg both its jaws are short, but they soon begin to lengthen, and it is a remarkable fact that the lower increases so much more rapidly than the upper that, by the

² Proc. Linn. Soc. N. S. Wales, vii, p. 592.

time the fry has attained a length of a couple of inches, it has all the appearance of a hemirhamphid, nor is it until considerably later in life that the beak assumes the normal adult form.

Key to the Genera.

- | | |
|--|------------------------|
| α^1 . Gill-rakers developed | i. BELONE. |
| α^2 . Gill-rakers absent or vestigial. | |
| b^1 . Three pair of upper pharyngeals (2nd, 3rd, and 4th) dentigerous. | |
| c^1 . Body subterete or but moderately compressed | ii. TYLOSURUS. |
| c^2 . Body strongly compressed | iii. ATHLENNES. |
| b^2 . One pair only of upper pharyngeals (3rd) dentigerous | iv. XENENTODON. |

ATHLENNES Jordan & Fordice.

Athlennes Jordan & Fordice, Proc. U. S. Nat. Mus., ix, 1886, p. 345 (*hians*); Jordan & Evermann, Bull. U. S. Fish. Comm., xxiii, 1903, p. 125; Regan, Ann. & Mag. Nat. Hist. (8) vii, 1911, p. 332.

Body elongate and strongly compressed, the sides flattened. Jaws slender, the premaxillary elevated proximally; base of mandible very deep. Anterior dorsal rays forming a lobe. No gill-rakers. Second and third upper pharyngeals dentigerous; lower pharyngeal elongate and narrow, the dentigerous plate scarcely expanded.³

Belonids of moderate size from the warmer parts of the Western Atlantic, Pacific, and Indian Oceans. Three perhaps four closely allied forms have been described; some authorities unite them in one species, under the name *Athlennes hians*.

Remarks:—Some six years ago the late Dr. Albert Gunther⁴ united under one name, *Belone hians*, all the various forms of *Athlennes* known to him. For reasons given below I am not disposed to concur in this view, believing that the typical Western Atlantic species, *A. hians* Valenciennes,⁵ is quite distinct from the North-Western Pacific *A. schismatorhynchus* Bleeker,⁶ from the Eastern Australian *A. caruleofasciatus* Stead, and probably from the Hawaiian form associated with *A. hians* by Jordan and Evermann.⁷ Of the Indo-Ethiopian species, *Belone melanostigma* Valenciennes,⁸ I am not in a position to form a judgment, because of the meagreness of the two descriptions to which I have access, those of Valenciennes and Day⁹ (who makes it synonymous with *schismatorhynchus*); in neither of these descriptions is any mention made of the remarkable compression of the body nor the conspicuous premaxillary ridge, the two dominant characteristics of the species, if it be identical with the Japanese fish and an *Athlennes*. In 1908 Stead, under the name of *Tylosurus caruleofasciatus*, added, from the New South Wales coast, yet another *Athlennes* to the above list; it is with this form, which has recently been obtained in

³ Jordan & Evermann say of this generic title—"This name was inadvertently written '*Athlennes*' by its authors, and as this form has now been several times used it may remain so. *Ablennes* was intended, as the etymology shows; *Athlennes* is meaningless, but euphonious."

⁴ Fische d. Sudsee, p. 353.

⁵ Hist. Nat. Poiss., xviii, p. 432.

⁶ Atlas Ichth., vi, p. 49.

⁷ Bull. U. S. Fish. Comm., xxiii, p. 125.

⁸ Ibid., p.

⁹ Fish. India, p. 510

Moreton Bay, that I am principally concerned. From Valenciennes' original description of the West Atlantic fish our species differs in having—the greatest height of the body situated immediately in advance of the ventral fins, where it is fully one seventh more than at the origin of the anal; a longer beak, ours being two and a third times the rest of the head as against his "not quite twice"; the lower border of the maxillary dilation exposed, even when the jaws are pressed closely together; the greater part of the cephalic groove smooth, nowhere granulose; the thoracic region broadly rounded below, not trenchant; the branchiostegal membrane exposed; fewer dorsal rays. In Jordan and Evermann's description of the same fish¹⁰ the authors state that—the width of the body is "not half of its greatest depth," that the caudal peduncle is "not compressed," that the snout is only "twice the rest of the head," that the maxillary is entirely concealed by the preorbital," and that the insertion of the ventrals is "midway between front of arch of upper jaw and base of caudal." Not one of these characters agrees with our species, which should, therefore, be definitely separated from *A. hians*. These authors, however, refer the Hawaiian form to *A. hians*, but here again discrepancies occur between our descriptions. For instance they write—Head 2.6 (2.1),¹¹ depth 9 (8.4) in trunk; width of head about 2 (1.6) in its depth; eye about 2 (2.25) in post-orbital head; dorsal (and anal) lobe much produced, "equal to head behind the anterior border of nasal depression" (*see figure*) (less produced, only equal to postorbital head), pectoral with 12 (14) rays, its length 3.3 (3.6) in head, ventral a little over 4 (5.1) in head. As regards the Japanese *A. schismatorhynchus*, included by Günther in the synonymy of *A. hians*, the task of differentiation with our species is more difficult, nevertheless valid characters separating them can I think be found. From Jordan and Starks¹² description of *A. schismatorhynchus* our fish differs in its more robust form, its much longer head, longer jaws, longer pectoral, and differently shaped dorsal.

ATHLENNES CÆRULEOFASCIATUS (Stead).

(Plate XIV.)

Tylosurus cæruleofasciatus Stead, New Fish, N. S. Wales, No. 1, Sept. 1908, p. 3, pl. i.

BARRED NEEDLE-FISH.

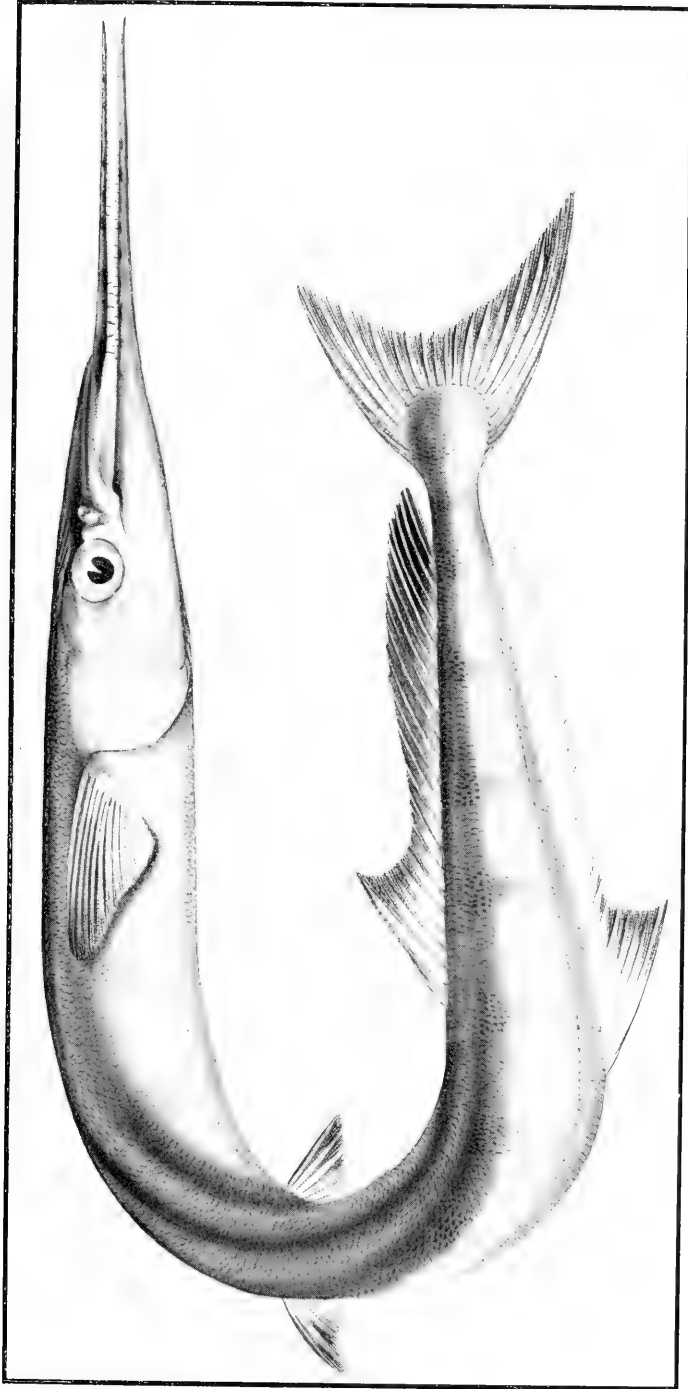
Type locality:—Port Stephens, N.S.W.

Body compressed, its width 1.85 in its depth, which is 14.3 in its length and equal to the head behind the middle of the eye. Caudal peduncle about one eighth deeper than wide immediately behind the dorsal fin, its depth 1.7 in its length and 1.25 in the eye-diameter. Depth of head five eighths more than its width and 5.15 in its length, which is 3.55 in that of the body. Post-orbital length of head 3.4 in the length of the snout, which is 5.05 in the body-length. Jaws long and slender, of nearly equal length, not meeting posteriorly when the mouth is closed. Proximal portion of premaxillary forming an elevated ridge, which terminates in an acute point, its length 2.85 in that of the snout; maxillary not entirely concealed by the preorbital; proximal portion of lower jaw exceedingly deep, its greatest depth 2.33 in the postorbital head. Diameter

¹⁰ Fish, North & Mid. Amer., p. 718.

¹¹ The measurements in brackets belong to *A. cæruleofasciatus*, and are inserted here to facilitate comparison.

¹² Proc. U. S. Nat. Mus., xxvi, p. 528.



Phyllis Clarke, del. *ATHLENNES CAERULEOFASCIATUS* (Stead). $\frac{1}{3}$ Nat. Size.

of eye a little less than the interorbital width and 2.25 in the postorbital head. Upper surface of head with a shallow groove, the borders of which converge anteriorly; supraciliary and supranasal regions striated.

Enlarged teeth short and slender, the series commencing a short distance behind the tip of the premaxillary crest, and rapidly fining down towards the tip, near which they become obsolescent; tongue smooth.

Scales small and adherent; cheeks, upper anterior portion of opercle, parietal region, and anterior part of the cephalic groove scaly. Lateral line extending to the caudal fin, not keeled posteriorly.

Dorsal fin with 23-24 rays, originating above the 6th anal ray, the space between its origin and the caudal fin equal to the length of the snout; 2nd ray longest, as long as the postorbital head and two and two thirds times the length of the 7th and shortest ray, beyond which they increase gradually to the 15th, which is about one sixth less than the 2nd; last ray not produced, not quite extending to the caudal. Caudal fin emarginate, the middle rays 2.25 in the lower lobe, which is half as long as the snout. Anal fin with 26 or 27 rays, as long as the snout, terminating a little in advance of the end of the dorsal; 2nd ray longest, one sixth higher than the dorsal lobe, and as long as the head behind the middle of the eye; last ray short, extending rather more than half way to the base of the caudal. Pectoral pointed, with 14 rays, as long as the head without the snout, and 12.5 in the length of the body. Ventral originating about one eighth nearer to the eye than to the root of the caudal, its length equal to the postorbital head.

Distance of vent from anal 3.33 in that from the origin of the ventral.

Back with a narrow dark-green vertebral stripe from the occiput to the dorsal fin; below this is a broad sea-green band extending to the tail; below this again is an equally broad plumbeous band, which throws off about 13 rather obscure vertical shoots into the pearly white of the sides and lower surface. Upper edge of opercle, hinder border of preopercle, upper eye, preorbital, and premaxillary crest black. Dorsal fin posteriorly sea-green with a blackish border, the posterior produced area uniform black; caudal greenish gray, the bases of the middle rays plumbeous; outer half of anal lobe dusky; upper ray, outer half, and posterior base of pectoral blackish; ventral with a black basal spot and broadly tipped with blackish. (*caeruleus*, blue; *fasciatus*, barred.)

Described from a fine specimen, 600 millim. in length, obtained in Moreton Bay, and secured for the Queensland Museum through the acumen of Mr. William G. Beach, Secretary to the Brisbane Fish Market, who recognized it at once as a species of "Long Tom" with which he was unacquainted.

Historical.—Prior to Mr. Beach's discovery of this species in a consignment of fishes sent to the Brisbane Market from Moreton Bay, our only knowledge of it consisted of the account given by Stead in the paper to which reference is made above. He there writes as follows:—"In the month of April, 1904, four specimens of a remarkable Long-Tom, of a species hitherto unknown, were received (through the observation of Dr. James C. Cox, M.D., F.R.C.S.E., Commissioner of Fisheries) from Mr. J. E. Chinnery, fishmonger of this city. From the latter gentleman's evidence, as well as from that of one of the Department's Inspectors, it transpired that they had been captured in the one haul with Garfish (*Hemirhamphus*) at Port Stephens." Only one of Stead's specimens, a fish measuring 470 millim., was perfect.

Uses.—Naturally with a fish which is so scarce in our seas we have no data as to its edible qualities, but there is no reason to believe that it differs in any respect from its congeners, of one of which, the Western Atlantic *A. hians*, we learn from Valenciennes on the authority of Poey that "it is good eating."

Range.—East Coast of Australia. Moreton Bay (*Ogilby*); Port Stephens (*Stead*).

Dimensions.—To at least 600 millim.

Illustration.—Miss Clarke's beautiful figure is taken from the Moreton Bay specimen previously referred to.

PART V.—HETEROSOMATA (No. 1).

ORDER HETEROSOMATA.

"THE FLAT-FISHES."

No one who with open eyes regards the works of Nature, which encompass him on every side in such prodigal profusion, can have failed to notice the want of symmetry which, through having both eyes situated on the same side of the head, characterizes these fishes in the adult state. Except during the earliest stage of their existence the flat-fishes lie at the bottom, when quiescent, on one or the other side, which may be right or left according to the family to which the individual belongs; for an obvious reason these sides are technically termed "eyed" or "blind." The eyed side is invariably colored owing to its exposure to the light, while the blind side, being turned downwards and, therefore, not affected by the rays of the sun, is normally colorless. Exceptions, however, occur to both these laws, for it is not uncommon to find reversed examples among all forms of flat-fishes, so that a normally "dextral" species—that is a species having the eyes on the right side—becomes individually "sinistral"—having the eyes on the left side—and *vice versa*; specimens too are occasionally taken, which are more or less fully colored on both sides. Indeed it is well known that certain species, among them our "Queensland Halibut" (*Psettodes erumei*) are dextral or sinistral in about equal numbers. It is probable that the species, which exhibit this divergence from the common law in a more marked degree, are more directly descended from their percoid ancestry, than those which have developed a more constant dextrality or sinistrality.

For many years it has been known that the young flat-fish, on its emergence from the ovum, has the eyes, like those of other fishes, placed symmetrically on the opposite sides of the head, and that at this period the body assumes a vertical position when the fish has occasion to move from place to place. At a very early age, however, one eye is forced round the dorsal surface of the head, and thenceforward becomes the upper eye, as distinguished from the lower, in which no such compulsory migration has taken place. The relationship of the eyes to one another, both as to size and position, varies greatly in the different genera, and when taking the proportionate measurements of the eye to the head, or more specially to the snout, it is preferable to utilize the lower eye, as being, from its immobility, the more constant. It is to this compulsory migration of an eye that the asymmetry of the frontal bones among

the flat-fishes is wholly due, that of the blind side being much the broader, while the frontal of the eyed side is displaced outwards and downwards to form an interorbital bar, the main portion of which is on the wrong side of the eye.

For a long time it was considered that the movement of the eye resulted in a torsion of the orbital region of the skull, but modern embryological research does not bear out this view. Rather it appears that of the two cartilaginous supraorbital bars, which in the larva are the precursors of the frontal bones of the adult fish, that part, which lies in the path of the migrating eye, is rapidly absorbed, and thus reduced to a pair of processes, directed respectively forward and backward, between which the eye passes and, in assuming its final position, causes a torsion of the supraorbital bar of the future eyed side, which also affects the ethmoid region, ossification not taking place until the migration is complete.

Recent research into the modifications of the orbital and nasal regions of the cranium, and the composition of the fin-rays in these fishes, tends to prove that the HETEROSOMATA, instead of being asymmetrical gadoids, as was held by earlier writers, have a closer affinity to the percoid fishes. *Psettodes*, in fact, with its spinous fin-rays to the dorsal and ventrals, and the more or less vertical position assumed by the body when the fish is moving rapidly, is merely an asymmetrical percoid. In other genera some of the dorsal, anal, and ventral rays are simple, and plainly represent spines reconverted to articulated rays.

Geologically the heterosomes date back only to the Upper Eocene, and are, therefore, a but recently differentiated group. Species inseparable from the existing genera *Bothus* and *Solca* have been discovered in that formation, but with these exceptions heterosome remains are few, fragmentary, and inconclusive. According to Regan the extinct *Amphistiidae* of the same geological age are percoids, with affinities to the recent genus *Psettus* (Diamond Fishes), or perhaps to *Platax*—near which it is arranged by Woodward¹—and hypothetically are the symmetrical prototypes of the flat-fishes. Up to the present time but one species—*Amphistium paradoxum* Agassiz²—has been discovered; it is associated by Boulenger³ with the *Zeidæ* (Dories).

Geographically the Order is practically cosmopolitan, being found in greater or less abundance wherever fisheries can be maintained, and though, as might be conjectured, it is richer in genera and species in the warmer seas, it is to the colder waters of the North Temperate Zone that we must turn, in order to find them in the full zenith of their power and influence.

Their bathymetrical distribution is also very great, for though the majority of flat-fishes lead a wholly marine life, many species prefer the muddy waters of estuaries to the purity of the open bay, and a few degenerates, chiefly of the soleiform group, elect to pass their entire existence in fresh water. A large number are denizens of the litoral zone, and, as they take a bait greedily and fearlessly, have thereby endeared themselves to the heart of the juvenile angler the world over. But a large and important section—those which enter into the economic food supply of mankind—is taken by the trawl-net, the boulder, and the hand-line, at greater depths offshore, even up to 300 fathoms, at which depth the halibut fishery of the Banks of Newfoundland is lucratively prosecuted.

¹ Brit. Mus. Catal. Foss. Fish., iv, 1901, p. 434.

² Poiss. Foss., v, pt. i, p. 44, pl. xiii.

³ Cambridge Nat. Hist., vii, 1904, p. 684, fig. 417.

Many species descend to below the 500 fathoms line, and a few to much greater depths. *Citharichthys dinoceros*,⁴ for example, was trawled by the "Blake" off Barbados from the enormous depth of 955 fathoms (a mile and an eighth of vertical depth), and a congener of the small but sweet-flavored "dab" (*Limanda limanda* 'Linnaeus'⁵) of the British seas was brought up by the "Albatross" from 896 fathoms, and was christened *Limanda beanii* by the late Dr. Brown Goode.⁶

The HETEROSOMATA may be defined as follows:—"Asymmetrical physoclists having the body strongly compressed with short precaudal region; mouth more or less protracile, the premaxillaries forming the entire dentigerous border of the upper jaw; eyes situated on the same side of the head in the adult. Dorsal and anal fins long; caudal with 18 or fewer principal rays, the outer ray above and below usually simple; ventral fins thoracic or jugular, with 6 rays or less. Air-bladder absent in the adult. Interorbital bar mainly formed by the frontal of the eyed side, that of the blind side extending to the prefrontal external to the upper eye; no orbito-sphenoid; parietals separated by the supraoccipital. Vertebral column composed of solid centra, co-ossified with the arches; posterior precaudal vertebrae with downwardly directed parapophyses. Pectoral arch attached to the skull by a forked posttemporal; no mesocoracoid; pelvic bones distinctly attached to the cleithra."

Though not to be compared, in point of number and variety of species, with the percomorphous stock from which they are descended, the flat-fishes are, nevertheless, a numerous and well-defined group, of great commercial importance to all maritime nations. It is to these fishes that the great trawling industries of the world, which have their chief home in the North Atlantic, and in which so large an amount of capital is involved, owe their existence, and to them primarily they look to justify their continuance.

Although here in Australia we can not boast of the presence of such large and valuable food-fishes as the Turbot, Halibut, Plaice, Sole, and others of the British Seas, we have, notwithstanding, several genera of excellent quality and approved economic importance. Owing, however, to the lack of proper facilities for their capture and the scarcity of suitable fishing grounds off our shelving or coral-strewn coast-line, their value to the community has not been generally appreciated. On no part of the Australian coast has any bank—such as the Dogger Bank of the North Sea⁷—been made known by the Admiralty Surveys, nor is it probable that such exist.

Among Australian flat-fishes it is only necessary to mention such genera as *Symphurus*, *Synaptura*, *Ammotretis*, *Rhombosolea*, *Platophrys*, *Pseudorhombus*, and *Psettodes* to ensure recognition of the fact that the use of more intelligent and systematic means of capture, combined with scientific protection, will in course of time provide lucrative employment for numbers of our hardy fishing population, and bring within reach of every breakfast table an abundant supply

⁴ Goode & Bean, Bull. Mus. Comp. Zool., xii, 1886, p. 157.

⁵ Syst. Nat., ed. 10, 1758, p. 270.

⁶ Goode, Proc. U. S. Nat. Mus., 1881, p. 473.

⁷ This famous bank which has been for many years so unfailing a source of London's fish-supply, is now more prolific than ever, despite the enormous strain which has been laid upon its resources. This marvelous result has been realised solely through the increased attention which science has, during recent years, bestowed upon the conservation of the ova and young of valuable sea-fishes, and the necessity, for placing their natural food supplies under the jurisdiction of a competent and impartial Board, is year by year being more earnestly impressed upon the rulers of all progressive nations.

of cheap nutritious and dainty food. This desirable consummation, however, can not be reached without the hearty and honest co-operation of both providers and consumers.

All the members of this Order are ground-fishes, living and feeding at the bottom, and but rarely invading the realms of the surface fishes.⁸

The ova of all the marine heterosomes are pelagic, and the symmetrical young are chiefly captured by the tow-net in the open sea.

Adult flat-fishes progress by means of an undulating movement of the whole body, which is notably distinct from the vibratory pectoral undulations of the skates and sting-rays.

All the species are carnivorous, subsisting on smaller fishes, crustaceans, mollusks, sand-worms, and in fact on every living creature which they can master.⁹ Nor are some of them averse to feeding upon offal, even the lordly turbot if not preferring at least not disdaining a putrid bait.

Regan divides the HETEROSOMATA into two suborders, the monotypic *Psettodeoidea*, represented by the "Queensland halibut," and the *Pleuronectoidea*, comprising all the remaining flat-fishes. He further separates the latter in two divisions, the *Pleuronectiformes*, with two families and six subfamilies, and the *Soleiformes* with two families. The following key to such of the higher groups as are found in our waters should be useful to Queensland students.

- a*¹. PSETTODEOIDEA :—Dorsal fin not extending forward on the head, the anterior rays spinous; ventral fins with one spinous and 5 soft rays; palatine teeth present; nostrils subsymmetrical PSETTODEIDÆ.
- a*². PLEURONECTOIDEA :—Dorsal fin extending forward on the head, none of the rays spinous; ventral fins with 6 or less soft rays; no palatine teeth.
 - b*¹. Lower jaw prominent; preopercular border free; nostrils asymmetrical (*Pleuronectiformes*).
 - c*¹. Eyes on the left side (*Flounders*) BOTHIDÆ.
 - d*¹. Ventrals with a short base, inserted behind the clavicular arch (*Paralichthyinæ*).
 - d*². Ventral fin of eyed side with a long base extending forward in advance of the clavicular arch (*Platophryinæ*).
 - b*². Lower jaw not prominent; preopercular border adnate; nostrils symmetrical (*Soleiformes*).
 - e*¹. Eyes on the right side (*Soles*) SOLEIDÆ.
 - e*². Eyes on the left side (*Tongue Soles*) CYNOGLOSSIDÆ.

Regan defines the *Soleiformes* as follows:—

DIVISION 2.—SOLEIFORMES.

"Mouth small, terminal, subterminal, or inferior, the lower jaw never prominent; jaws of the blind side toothed, strongly curved, the convexity of the

⁸ The author, when floating in a Rob Roy canoe over a depth of about six feet with a calm sea, on the north coast of Ireland, once saw a plaice (*Pleuronectes platessa*), until then unobserved, dart from its sand-bed and seize a "cudden" (local name for the fry of the coal-fish—*Pollachius virens*) swimming at the surface, retiring then to the bottom to consume its prey at leisure.

⁹ I have seen a large sea-mouse (*Aphrodite aculeata*) taken from the stomach of a brill (*Bothus levis*), though one would imagine that a creature, the hairs of which come off so easily and have such an unpleasant habit of attaching themselves to whatever touches them, would be immune.

lower fitting the concavity of the upper; jaws of the eyed side not or but feebly toothed; preopercular margin not free. Nasal organs symmetrical in position; olfactory laminae arranged transversely to or radiating from a central rachis. Optic chiasma dimorphic, the right or the left nerve dorsal without reference to dextrality or sinistrality. No post-cleithrum; no pectoral radials, the rays inserted on the hypercoracoid; hypocoracoid reduced; pelvic fins supported by the pelvic bones, which are dependent from the lower extremities of the cleithra, which do not reach the ventral profile; precaudal parapophyses united or connected by a bridge to form closed hæmal arches; no ribs."

FAMILY I.—SOLEIDÆ.

THE TRUE SOLES.

Body ovate to elliptical, usually covered with small scales. Lateral line straight, sometimes extending on the caudal fin, the tubes simple. Head small; snout rounded and more or less projecting. Eyes on the right side, small, close together, the upper usually in advance of the lower. Caudal fin free, or confluent with the other vertical fins. Pectoral fins present or absent. Ventral fins small, usually both developed, but that of the blind side sometimes rudimentary or even absent, that of the eyed side sometimes median with extended base, separate from or united to the anal. Gill-openings narrow; gill-membranes broadly united below the throat, adnate to the shoulder-girdle above; branchiostegals six; gill-rakers rudimentary. Vertebrae 28 to 57 (9 or 10 + 19 to 48).

Fishes of small or moderate size, inhabiting all tropical and temperate regions, chiefly inhabiting sandy or muddy bottoms at a moderate depth; some, however, have taken on a purely fluviatile existence, such as the *Synaptura selheimi* of Macleay, these being more or less degraded forms; others are equally at home in fresh, brackish, or pure sea water; of such is our *Aserragodes macleayanus* Ramsay. though as far as my observations go the adults confine themselves to the more open waters, descending to a depth of at least 31 fathoms. Some species, however, descend to much greater depths, even the common sole (*Solea solea* Linnaeus), the most universally known of all the family, having been trawled by the "Travailleur" in 130 fathoms, while the same vessel brought up *Microchirus profundicolus* Vaillant from about 700. All the species are excellent eating, but few, however, are of any economic importance.

Our soles divide themselves naturally into two groups, one with separate, the other with confluent vertical fins. Appended is a key to the first group.

a¹. Vertical fins separate (*Soleinæ*).

b¹. Ventrals free from anal.

c¹. No pectoral fins.

d¹. No accessory lateral line on blind side.

e¹. Ventrals subsymmetrical i. ASERRAGODES.

d². An accessory lateral line on blind side.

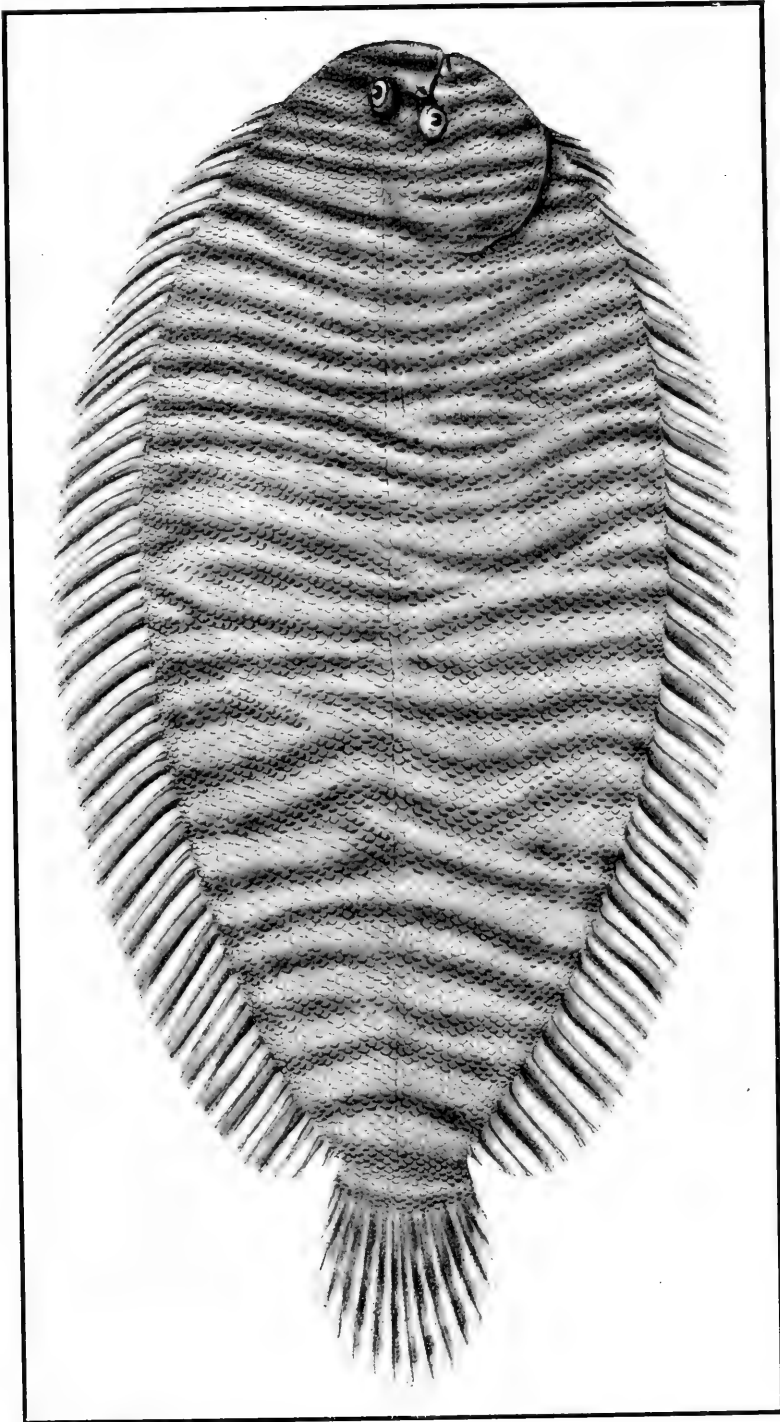
f¹. Dorsal and anal fins with a series of suprabasal pores; ventrals asymmetrical ii. PARDACHIRUS.

c². Pectoral fins present, that of eyed side the larger.

g¹. Rostro-frontal aspect concave; nasal tube of eyed side much produced iii. SOLEICHTHYS.

a². Vertical fins confluent (*Brachirineæ*).¹⁰

¹⁰ As Mr. McCulloch is now making an exhaustive study of the members of this subfamily, I shall await the result of his researches before dealing with the Queensland species.



ASERAGGODES MACLEAYANUS (Ramsay). Nat. Size.

Phyllis Clarke, del.

ASERAGGODES Kaup.

Aseraggodes Kaup, Arch. f. Nat., xxiv, 1858, i, p. 103 (*guttulatus*); Jordan & Starks, Proc. U. S. Nat. Mus., xxxi, 1907, p. 229.

Body ovate, obtusely rounded anteriorly, the caudal peduncle very short and deep. Scales small, adherent, etenoid, extending on the bases of the vertical fins; head everywhere scaly, except the snout of the eyed side and a narrow stripe on the blind side, from the snout to the apex of the branchial aperture, which is densely clothed with skinny filaments. Lateral line straight, extending on the head and caudal fin, the pores simple. Head small, the snout without hook, not or but little projecting beyond the lower jaw. Mouth terminal or subterminal, narrower on the blind side than on the eyed. Anterior nostril on both sides tubular. Eyes small, the upper a little in advance of the lower, separated by a narrow scaly concave interspace. Dorsal originating on the snout, anal slightly in advance of the opercular angle; most of the rays divided, with the tips free, and a skinny pleat on the blind side. Caudal fin sharply rounded, with 18 rays, of which 15 are divided. No pectoral fins. Ventrals subsymmetrical, the right but little longer and not higher than the left, the rays simple, both inserted symmetrically on the edge of the abdominal ridge, and separate from or united to the anal. Gill-openings narrow; gill-membranes broadly united below; gill-rakers rudimentary. Vent submedian. (*a*, priv., σπηραγγώδης, full of pores.)

Small thick soles, inhabiting the inshore waters of the Australian and Malayan Seas, ranging northward to Japan and eastward to the Solomons and Lord Howe Island. About a dozen species known.

ASERAGGODES MACLEAYANUS (Ramsay).

(Plate XV.)

- Solea Macleayana* Ramsay, Proc. Linn. Soc. N. S. Wales, v, pt. 4, 20 May 1881, p. 462; Macleay, Proc. Linn. Soc. N. S. Wales, vi, 1881, p. 135; id., ibid., vii, 1882, p. 15.
Solea fluviatilis Ramsay, ibid., vii, pt. 1, 23 May 1882, p. 111; Macleay, ibid., ix, 1884, p. 50; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 49.
Solea macleayana Woods, Fish & Fisher. N. S. Wales, 1882, pp. 21, 77; Ogilby, ibid.; id., Edib. Fish. N. S. Wales, 1893, p. 159; Stead, Fish. Austr., 1906, pp. 183, 264.
Aseraggodes macleayanus Ogilby, Proc. Linn. Soc. N. S. Wales, xxi, 1897, p. 817; id., Proc. Roy. Soc. Queensl., xxi, 1908, p. 25; id., List Edib. Fish. Moreton Bay, 1911, p. 1.
Aseraggodes macleayana Waite, Mem. Austr. Mus., iv, 1899, pp. 29, 124, pl. xxix; id., Synops. Fish. N. S. Wales, 1904, p. 44; Stead, Edib. Fish. N. S. Wales, 1908, p. 105, pl. lxxii.

NARROW-BANDED SOLE.

Type localities:—Manly Beach, N.S.W. (*S. macleayana*).

Hunter River, N.S.W. (*S. fluviatilis*).

Sides of body nearly parallel from behind the head to well beyond the middle, thence gradually converging to the peduncle, the depth of which is 3.5 to 4 in that of the body, which is 2.1 to 2.3 in its length. Head deeper than long, its length 5 to 5.3 in that of the body. Snout short, its tip on a level with the inferior border of the lower eye, its length from that eye 3.6 to 3.8 in that of the head. Cleft of mouth extending to below or a little beyond the anterior border of the lower eye. Anterior nostril of colored side tubular, wide, situated in front of the upper half of the lower eye; posterior valvular, pierced in the

angle between the eye and the lip; nostrils of blind side tubular, widely separated, the anterior opening near the edge of the snout, the posterior behind the vertical from the angle of the mouth. Eyes of equal size and ovate, their horizontal diameter 1.65 to 2 in the length of the snout, 6.25 to 6.6 in that of the head, and from two thirds to one diameter more than the interorbital width. Width of gill-opening 1.45 to 1.55 in the length of the head.

Scales of body and head strongly ctenoid on both sides, the marginal teeth from 6 to 10 in number. Snout and lips of both sides and a wide stripe between the lower jaw and the gill-opening of the blind side naked, the edges and all the naked area of the latter closely covered with short cirri, a series of which is continued to the apex of the gill-opening, the edge of which on the colored side is acirrate. A single median lateral line on each side, extending from near the tip of the caudal fin to the preopercular region, where it bends upwards and slightly forwards. Body-tubes of lateral line 90 to 100; transverse series of scales 32 or 33 / 33 to 35.

Dorsal fin with 62 to 66, anal with 48 to 52 rays, the former originating a little above the level of the upper eye; the highest are inserted in the third quarter of each fin and are from two thirds to four sevenths of the length of the head; those of the anal are slightly the lower. Caudal fin variously rounded, its length 5 to 6 in that of the body.¹¹ Ventrals originating on the same level, 5-rayed, the right about one fifth longer but slightly lower than the left, its 5th ray short, united to the anal by its basal two thirds; last ray of left ventral much longer and free.

Lavender gray, with from 32 to 36 narrow brown cross-bars, which are usually rather wider than the interspaces, and of which 6 or 7 are on the head and 1 or 2 on the base of the caudal fin; these bars are very irregular in shape, the anterior ones often having a slight backward arch, those about the middle of the body straight or undulous and often forked, and the posterior ones arched forwards; membranous part of all the fins darker than the rays. (Named after Sir William John Macleay, in recognition of his valuable services to Australian biology.)

Described from three examples, measuring 192, 168, and 154 millim., taken respectively off Point Lookout and Low Bluff and in Moreton Bay. The largest and smallest were kindly lent to me by the officers of the Amateur Fishermen's Association.

Historical.—During the year 1880 the Trustees of the Australian Museum purchased a small otter trawl for use in Port Jackson and, the Government of the day having placed the steam launch "Mabel" at their disposal, Saturday afternoons were for several years devoted to the exploration of Sydney Harbor, its inlets, and its affluent, an enterprise which largely contributed to our knowledge of the marine fauna of that area. This handsome sole was one of the earliest products of the venture, having been "taken in the net at Manly [inner] Beach, September 11th, 1880, with *Solea microcephala*," as recorded by Dr. Ramsay. In the following year the same author received a small sole (76 millim.)

¹¹ In two of my examples the caudal fin is short and broadly rounded as shown in Waite's figure, the exact proportional measurements being as 1—5.98 and 1—6.06; in the other it is longer and more sharply rounded, with a measurement of 1—4.94. None of my specimens are in spawn, so that I am unable to determine whether the character is sexual or individual, and Waite unfortunately does not mention the sex of the specimen figured.

from "Freshwater, Hunter River" and, possibly misled by the different character of the element in which it was found, redescribed it as *Solea fluviatilis*, his two descriptions being almost word for word the same. No further information was published regarding it till 1893 when I (3) was able to publish some particulars as to its frequency, distribution, and food-value. These notes were supplemented by Waite in his "Thetis" Report, who not only considerably increased its southward and northward range, but was able to fix the spawning season for Middle New South Wales, a most important advancement in the sum of our knowledge of the economy of the species. Some years later Stead increased its range north to Port Macquarie, while in the same year I was able to announce its presence in Queensland waters, several young examples having been brought to me for identification by Mr. William Nicklin, who obtained them in the Brisbane River.

Reproduction.—In my "Edible Fishes of New South Wales" I stated that these soles "are occasionally found in considerable numbers, especially during the spring months, when they come in apparently from the open sea in shoals, all being of large size and about the same length; these school fish are very thick and firm and of delicious flavor, but are without rudiments of spawn." Waite's investigations on board the "Thetis" tend to confirm my observations, for he writes that "all the specimens of sufficient size were full of almost ripe ova, and as the extreme dates are the 2nd and 19th March, the end of that month may be approximately determined as the spawning season," and elsewhere "we . . . discovered the breeding season to be March and April." These remarks apply to the coast of New South Wales between Shoalhaven Bight and Cape Hawke, and we may naturally infer that with us the season would be a full month later or the latter part of April and May. This supposition receives a partial confirmation in that none of the 15 adult examples captured by the "Endeavour" in the neighborhood of Moreton Bay during the first week of September showed signs of breeding. It will be noticed that at least three of the stations where spawning fishes were trawled by the "Thetis" lie off the mouth of considerable rivers (Shoalhaven and Hunter), and I believe that the procedure may safely be outlined thus:—In the spring of the year the fishes, which have spent the winter months in moderately deep water, begin to draw inshore, and this movement doubtless continues with more or less regularity throughout the summer, during which time the ova is gradually ripening, that of the individuals which make their way shorewards earliest coming to maturity sooner than that of the later arrivals. As the time for shedding the spawn approaches the fishes collect in the vicinity of river mouths, where they shed their pelagic ova, after which operation they retire once more to deeper water to recoup. The young fishes, as soon as the yolk-sac is absorbed, make their way into the estuaries, and gradually work up these even to far beyond the limit of the tide, as we know from the Hunter River example described by Ramsay as *Solea fluviatilis*, and from a specimen exhibited by me at a meeting of the Linnean Society of New South Wales, which was captured at Codrington, a township on the Richmond River 58 miles above its mouth.

Uses.—A delicious pan-fish, fully equal in flavor to its famous European relative, *Solea solea*. Waite writes—"As to its edible qualities all on board the 'Thetis,' where it was freely partaken of, pronounced it to be of admirable

flavour." Stead makes no remark as to its quality, but contents himself with stating that it "may be considered as likely to be of some use as an adjunct to our food-supply in the near future."¹²

Range.—Coasts of New South Wales and Southern Queensland from the Shoalhaven Bight in the south to the Moreton Bay District in the north. From our own coast I have seen specimens from Currumbin Creek, Southport, Moreton Bay, Brisbane River, and from the "Endeavour" stations—off South Hill in 13 fath. on fine dark sand 2, off Point Lookout in 31 fath. on fine sand and shell 6, off Cartwright Point in 24 fath. 4, and off Low Bluff in 15 fath. 3, both these latter on fine sand. According to Waite the "Thetis" also obtained it at four stations, namely—Newcastle Bight in 19 to 16 fath. on "mud and sand to pebbles"; off Newcastle in 21 to 48 fath. on sand and mud; off Cape Hawke in 10 to 12 fath. on sand to gravel; and off the Shoalhaven River in 15 fath. on sand. Regarding the second of these stations Waite remarks—"Although 21-48 fathoms was sounded at Station 24 it is quite possible that this fish was taken when the trawl was first lowered and before it descended to greater depths. It may be further pointed out that it was obtained most abundantly in the shallowest water wherein we trawled," which is diametrically opposed to the "Endeavour's" experience here; this only shows that, as suggested above, the breeding fishes were drawing in to the shallow water off the mouths of rivers preparatory to shedding their spawn, while the stripped fishes were widely scattered over the ocean bed at a much greater depth.

Dimensions.—As both Waite and I found 280 millim. (11 in.) to be the largest size obtainable, this may be taken as the maximum length to which the species attains. A more usual size is from 200 to 225 millim., and Waite records that "it is mature at a much smaller size, for a large number of our specimens measuring only six inches in length were in full spawn."

PARDACHIRUS Günther.

Pardachirus Günther, Brit. Mus. Catal. Fish., iv, 1862, p. 478 (*marmoratus*).

Body ovate, obtusely rounded anteriorly, the caudal peduncle very short and deep. Scales small, adherent, variously armed, extending on the bases of the vertical fins; head everywhere scaly; edges of snout, lower jaw, and branchial aperture fringed, under surface of snout and lower jaw densely clothed with skinny filaments. Lateral line straight, that on the blind side extending forwards by a gentle curve to the snout, where it joins a second line, which runs from the tip of the snout close below the upper profile of the head and nape; vertical fin-rays each provided with a pair of open pores. Head small, the snout projecting beyond the lower jaw, but without hook. Mouth small and lunate, narrower on the blind side than on the eyed. Teeth minute and setaceous, in villiform bands, on the blind side only. Anterior nostril of eyed side and both nostrils of blind side tubular; posterior nostril of eyed side simple, close in front of the lower eye, and concealed beneath the ascending flap of the lower lip. Eyes small, dextral, separated by a narrow scaly concave interspace, the upper a little in advance of the lower. Dorsal originating in front or a little below the upper eye, anal below the opercular angle, the rays divided, with the

¹² We are looking forward with great interest to Mr. Stead's first report on the proceedings of the New South Wales trawlers—Koraaga, Gunnundaal, and Brolga. Much important information regarding the breeding places and seasons of our food-fishes may, and it is hoped will, be obtained through their instrumentality. We wish the New South Wales Government and Mr. Stead all good fortune in this venture, and trust that the Government of this State will as soon as possible emulate their praiseworthy and patriotic action by stimulating the scientific development of our fisheries on the lines laid down by me in letters to local journals.

tips free. Caudal broadly rounded, with 18 rays. No pectorals. Ventrals asymmetrical, the right the larger, inserted on the abdominal ridge, but not connected with the anal. Gill-opening narrow; gill-membranes broadly united below the throat; branchiostegals 6; gill-rakers rudimentary. Vent situated on the left side behind the left ventral. (*παρδος*, a leopard; *Achirus*, an allied genus.)

In some specimens there is a simple papilla situated on the abdominal ridge in front of the anal and on a level with the vent; in others there is a broad cutaneous flap embracing not only the vent but the origin of the anal fin. That this is a sexual character there can be no doubt, but as none of my specimens are in spawn I cannot determine to which sex each belongs.

Small thick soles, inhabiting the litoral waters of the Indian and Western Pacific Oceans. About 4 species.

The characters which are supposed to separate the five genera of soles, in which the pectoral fins are wholly wanting, are slight and unconvincing. *Pardachirus*, however, is said to differ from all the others in the presence of a series of conspicuous open pores situated along both sides of the bases of the vertical fins. With these is correlated an accessory lateral line on the blind side anteriorly. But this latter character it only possesses in common with *Liachirus*, which is in fact nothing more nor less than a poreless *Pardachirus*. Again, Günther's statement regarding his own genus *Pardachirus*, "scales not ciliated, or only a few with inconspicuous cilia," cannot be maintained. Not only are the scales of the Port Jackson species, hitherto known as *P. pavoninus*, conspicuously ctenoid everywhere on both sides, but the same has been noticed by Day of the Indian *P. maculatus* Schneider, and by Kendall and Goldsborough of a supposed specimen of *P. pavoninus* from Tonga. The positions of the four Bleekerian species of *Achirus*, namely, *A. melanospilos*, *A. poropterus*, *A. thepassii*, and *A. hartzfeldii*, are most confusing. Jordan and Richardson refer the two latter to the genus *Amate* Jordan and Starks. Granted that the long-snouted *A. hartzfeldii* may with propriety be placed in the same section as *Amate japonica*, the like cannot be said for the short-snouted *A. thepassii*. This species, with *A. poropterus*, oscillates between *Aseraggodes* and *Pardachirus*, having the single lateral line of the former and the basiradial pores of the latter. If, therefore, both these genera are valid, a new name will be required for Bleeker's species. Similarly the smooth-scaled *A. melanospilos*, being practically a *Liachirus* with a single lateral line, should command yet another new generic name. Enough has been said to show that the status of the four genera *Aseraggodes*, *Pardachirus*, *Liachirus*, and *Amate* is very doubtful.

Key to the Species of Pardachirus.

- a¹. Scales everywhere cycloid *marmoratus*.
- a². Scale of head and sometimes of anterior trunk ctenoid, ocelli of colored side each with a dark central spot; back without black blotches *pavoninus*.
- a³. Scale everywhere ctenoid; ocelli of colored side usually without central spot; back with three series of black blotches *hedleyi*.

Day places in this genus, which he calls *Achirus*, the fish described by Schneider as *Pleuronectes maculatus*, and informs us that he had the privilege of examining the type, which is unique. His description of it as congeneric with *P. pavoninus* is, however, far from convincing. The hooked snout and the complete lepidosis of the vertical fins are not pardachirine characters, while the evidence as to the presence of radial pores is decidedly weak.

PARDACHIRUS PAVONINUS (Lacépède).

(Plate XVI.)

Achirus pavoninus Lacépède, Hist. Nat. Poiss., iv, 1902, pp. 658, 661; Cantor, Catal. Malay. Fish. 1850, p. 225; Bleeker, Nat. Tijds. Nederl. Ind., i, 1851, p. 402; id., ibid., iii, 1852, pp. 238, 446; id., Verh. Batav. Gen., xxiv, 1852, Pleuronect., p. 18; id., Nat. Tijds. Nederl. Ind., xii, 1857, p. 217; Kaup, Arch. f. Naturg., xxiv, 1858, i, p. 102; Bleeker, Act. Soc. Sci. Indo-Neerl., viii, 1850, Sumatra, p. 62; id., ibid., Celebes, p. 14; id., Versl. Akad. Amsterdam, xii, 1861, pp. 41, 69; id., ibid., xiv, 1862, p. 103; id., Nederl. Tijds. Dierk., ii, 1865, p. 184; id., Atlas Ichth., vi, 1870, p. 24, pl. cexli, fig. 1; id., Versl. Akad. Amsterdam (2) vii, 1873, p. 37; Day, Fish. India, pt. 3, 1877, p. 427, pl. xciii, fig. 2; Bleeker, Verh. Akad. Amsterdam, xviii, 1879, China, p. 3; Stead, Fish. Austr., 1906, pp. 183, 264.

Pleuronectes pavoninus Shaw, Gen. Zool., iv, 1804, p. 310.

Achirus maculatus (Kuhl & van Hasselt) Bleeker, Nat. & Geneesk. Arch. Ned. Ind., ii, 1845, p. 509; Verh. Batav. Gen., xxii, 1849, Madura, p. 6; id., ibid., xxiii, 1850, Mid-en Oost-Java, p. 12.

Pardachirus pavoninus Günther, Brit. Mus. Catal. Fish., iv, 1862, p. 479; Day, Proc. Zool. Soc. London, 1870, p. 699; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 247; Macleay, Proc. Linn. Soc. N. S. Wales, vi, 1881, p. 136; Kent, Great Barrier Reef, 1893, p. 297; Steindachner, Abh. Senck. Ges., xxv, ii, 1901, p. 443; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 413; Evermann & Seale, Bull. U. S. Bur. Fish., xxvi, 1907; Günther, Fisch. d. Sudsee, 1909, p. 346; Jordan & Richardson, Check-List Fish. Philipp. Archip., 1910, p. 54; Snyder, Proc. U. S. Nat. Mus., xlii, 1912, p. 517; Weber, Fisch. Siboga Exped., 1913, p. 439.

? *Pardachirus marmoratus* Kner, Reise Novara, pt. 3, 1867, p. 290. Not of Lacépède.

Solea (*Pardachirus*) *pavonina* Steindachner, Sitz. Akad. Wien, lx, 1870, p. 570.

PEACOCK SOLE.

Type locality:—East Indies (*A. pavoninus*).

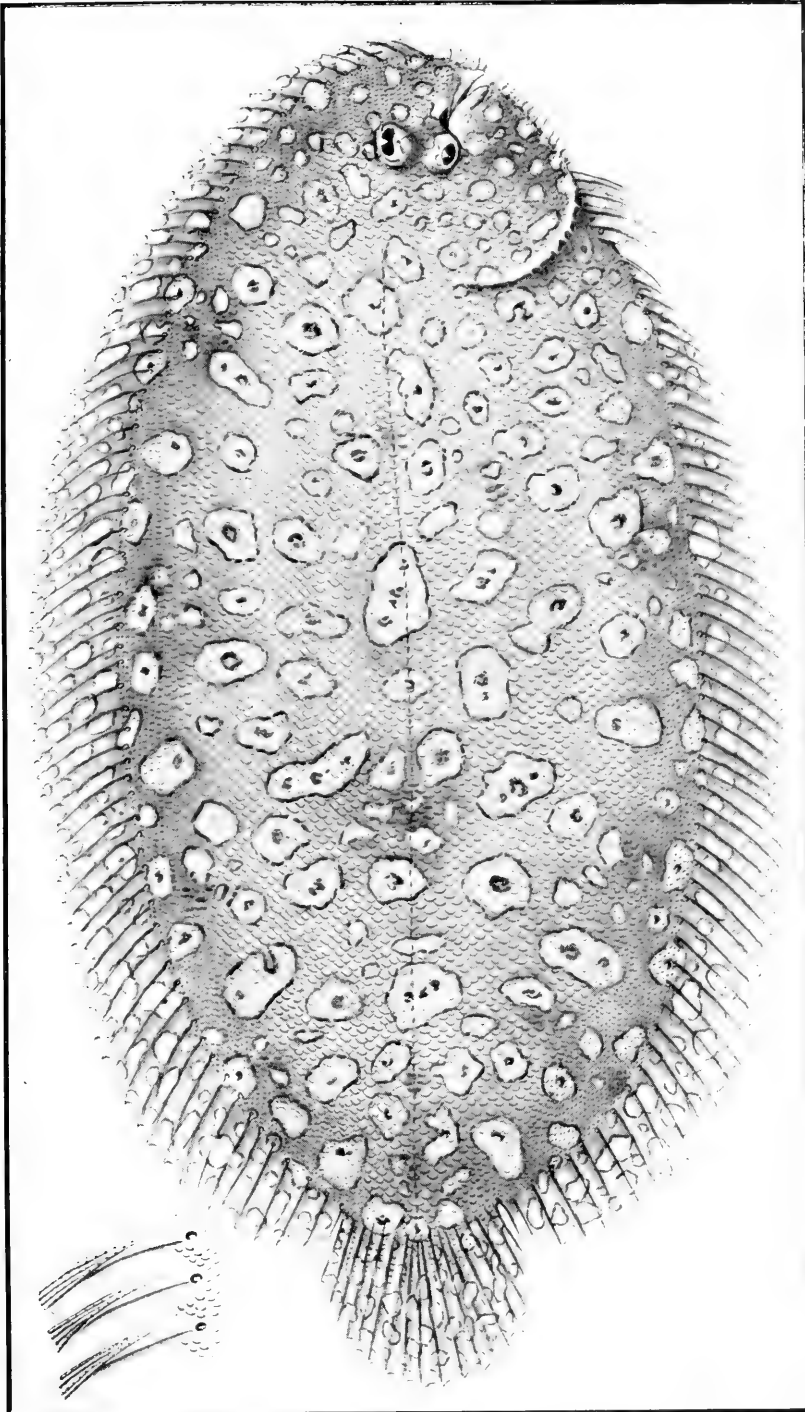
Java (*A. maculatus*).

Body ovate, its depth 2.2 in its length, that of the caudal peduncle 2.43 in the body-depth. Head somewhat deeper than long, its length 4.83 in that of the body. Snout short, its tip somewhat below the level of the lower eye, its length from that eye 2.85 in that of the head. Cleft of mouth extending to below the anterior third of the lower eye. Eyes equal, the diameter 5.9 in the length of the head. Width of gill-opening 1.5 in the same.

Scales of the upper side terminating in an ovate feebly spinulose patch, which becomes gradually weaker posteriorly, the margins smooth, except above the eyes where they bear 3 or 4 longer setæ; lower surface smooth, in 84 to 89 transverse series above the lateral line. Basal third of vertical fins scaly, the basiradial pore opening on the inner edge of the naked portion. Lateral line straight, continued to the extremity of the caudal fin, and on the head to the preopercular region where it divides, one branch passing upwards the other downwards.

Dorsal fin with 65 to 71, anal with 50 to 54 rays, all of which, except a few short ones in front and behind, are divided, the longest rays being about the commencement of the last third of the fin. Caudal fin broadly rounded, with 18 rays, its length 5.87 in that of the head. Each ventral with 5 branched rays.¹³

¹³ In the specimen described the right ventral has a short additional ray posteriorly, but as other observers give the formula as 5/5, I look upon this as an individual peculiarity.



PARDACHIRUS PAVONINUS (Lacépède). ♂ Nat. Size.

Phyllis Clarke, del.

Described from a single example, 205 millim. long, obtained at Raine Island, N.Q., and presented to the Queensland Museum by the Wanetta Pearling Company. Reg. No. I. 14/1917. The number of scales and of dorsal and anal rays is, however, supplemented by information kindly supplied by Mr. McCulloch.

Historical.—This beautifully marked sole was first made known to science in the early years of the nineteenth century by Lacépède, who placed it in the first subdivision of his genus *Achirus*, along with his *A. barbatus*, *A. marmoratus*, and *A. fasciatus*. The two first of these are congeneric with the subject of this article, nevertheless Cuvier arbitrarily selected a species—*Pleuronectes achirus* Linnaeus—of which Lacépède makes no mention, as the type of the restricted genus *Achirus*, and his example has unfortunately been followed by those writers who succeeded him, with the exception of Kaup, to whose honor it is that he restored *Achirus* to those fishes for which Lacépède originally designed it.¹⁴ In the edition of Lacépède's works to which I have access (Paris 1836) no locality is mentioned for this fish, but since it is stated that the type belonged to the collection of the Stadtholder, annexed from Holland by France during the Napoleonic wars, we may safely conclude that it came from the Dutch East Indies. With the exception of a passing reference by Shaw, who referred it back to the genus *Pleuronectes*, nothing more was heard of this fish until, under the name of *A. maculatus*, its presence in Batavian waters was announced by Bleeker some forty years later on the authority of the MSS. of Kuhl and van Hasselt. By the same name Bleeker subsequently recorded it from Madura and Sourabaya. Cantor in 1850, restoring Lacépède's name, reports a single specimen as having been obtained at Pinang some years previously. From this period until 1860 its history consists of a series of records by Bleeker for various islands of the Malay Archipelago; indeed, so far as that author is concerned, the series is continued up to 1879, when he added it to the Chinese fauna on the strength of a specimen contained in the Hamburg Museum; all these later records are given under *A. pavoninus*. In 1860 Günther initiated a new era in the history of this fish by forming for it and its Lacépédian congeners *A. barbatus* and *A. marmoratus*¹⁵ the genus *Pardachirus*, which is now generally recognised, the most notable exceptions being Day, who followed Kaup, and Ogilby, who followed Day and was followed by Waite and Stead. The earliest notice of its occurrence on the shores of Australia was published in 1877 by Alleyne and Macleay, who obtained their specimens at Capes Grenville and York, N.Q., during the Chevert Expedition. Two years later Castelnau included the species in a list of Port Jackson fishes, but the southern Peacock Sole is easily recognisable from its northern relative by the ctenoid character of its scales. Steindachner obtained a pair from Ternate, an island which is not represented in Bleeker's list. Coming to recent times Jordan and Seale extended its range to the New Hebrides, while Günther added New Britain, the Solomons, and the Tonga Group. Jordan and Richardson announced its presence in the Philippines, and Snyder recorded specimens from as far north as Okinawa, an island of the Riu Kiu Archipelago. Finally Weber reported it from Samoa, the most easterly point as yet noticed.

¹⁴ International zoological jurisdiction has, however, found it expedient to uphold the wrong-doer, and thus forced us into the incongruous position of accepting that which we know to be a manifest absurdity, or worse.

¹⁵ These are considered to be identical.

Uses.—Lacépède, writing of the allied *P. marmoratus*, states on the authority of Commerçon that "the flavor of its flesh is excellent," and from a single personal experience I can similarly affirm that the southern *P. hedleyi* is equally delicious. The mouth is too small to admit of its taking an ordinary hook, and it could only be taken in sufficient numbers for the table by the use of small otter trawls in water of not more than 7 or 8 fathoms. That it is almost wholly a fish of the litoral zone is borne out by the failure of the "Endeavour" to trawl even a single example on the Queensland coast.

Range.—From the shores of Northern Queensland westward through the Malay Archipelago to the Andamans and Pinang, and thence northward along the coast of China to the Riu Kiu Islands; northward and eastward from our shores it has been recorded from the New Hebrides (*Jordan & Seale*), New Britain, Solomons, and Tonga (*Günther*), and Samoa (*Weber*). On the Queensland coast it is known from Capes Grenville and York, N.Q. (*Alleyne & Macleay*); Raine Island, B.R. (*Ogilby*); and Darnley Island (*Tosh Coll.*). Turning westward we find it recorded from the Aru Islands, Ceram, Batchian, Celebes, Madura, Java, Banca, Singapore, Nias, and Sumatra (*Bleeker*); Ternate (*Steindachner*); Bacon, P.I. (*Evermann & Seale*); Pulo Pinang (*Cantor*); Andaman Islands (*Day*); China Sea (*Bleeker*); and Okinawe (*Snyder*).

Dimensions.—The largest of which I can find any record measures 209 millim., and is the Raine Island example—I. 15/2491—which Miss Phyllis Clark has so beautifully illustrated.

PARDACHIRUS HEDLEYI sp. nov.

(Plate XVII.)

Pardachirus pavoninus Castelnau, Proc. Linn. Soc. N. S. Wales, iii, 1879, pp. 355, 362; Macleay,

Proc. Linn. Soc. N. S. Wales, vii, 1882, p. 13. Not of Günther 1862.

Achirus pavoninus Ogilby, Catal. Fish. N. S. Wales, 1886, p. 49; Waite, Synops. Fish. N. S. Wales, 1904, p. 44; Stead, Edib. Fish. N. S. Wales, 1908, p. 106. Not of Lacépède 1802.

? *Pardachirus pavoninus* Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 332.

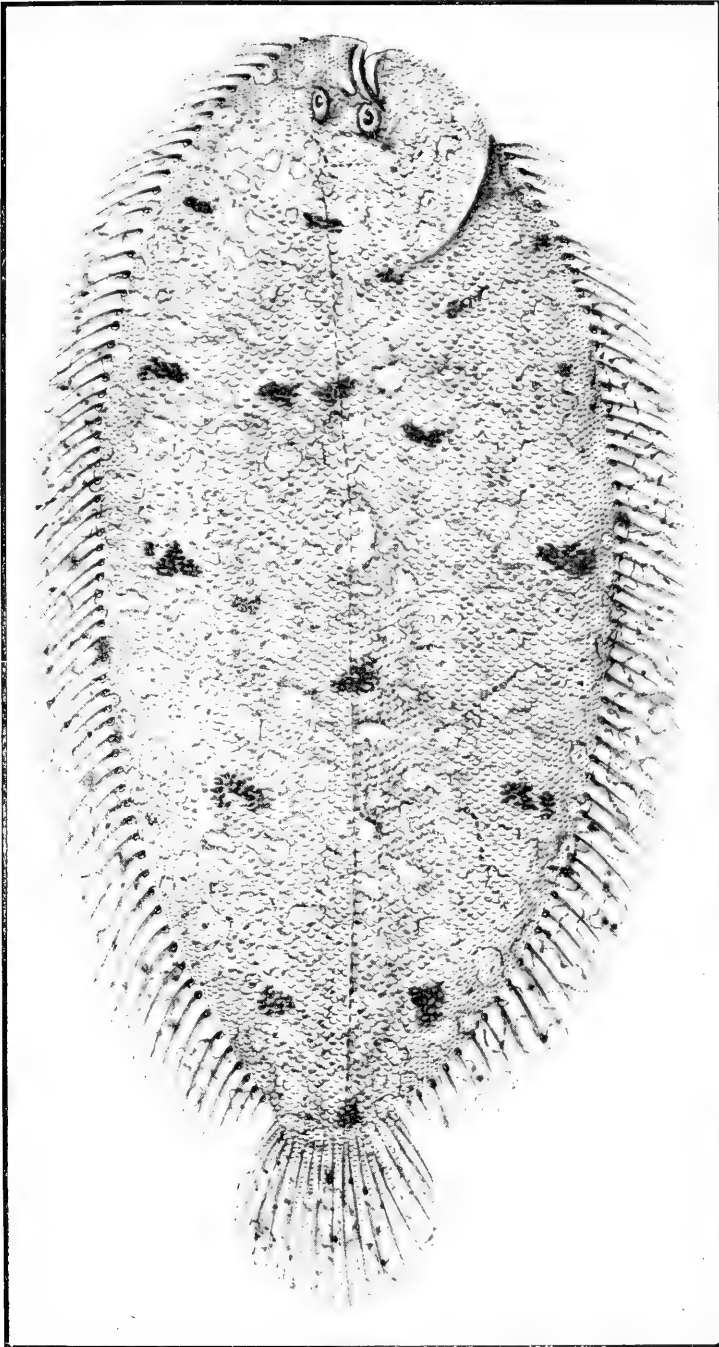
Type locality.—Port Jackson, N.S.W.

Body ovate, its depth 2.3 to 2.55 in its length,¹⁶ that of the caudal peduncle 3.5 to 3.65 in the body-depth. Head about one fifth deeper than long, its length 4.6 to 5 in that of the body. Snout short, its tip slightly below the level of the lower eye, its length from that eye 3 to 3.5 in that of the head. Cleft of mouth extending to below the middle of the lower eye or not quite so far. Eyes equal, the diameter 6.2 to 6.67 in the length of the head. Width of gill-opening 1.45 to 1.6 in the same.

Scales of both sides terminating in an ovate spinulose patch, the margin of which is armed with about 8 longer and stronger teeth, in 82 to 90 transverse series, immediately above the lateral line. Only the basal third of the vertical fins is scaly, and the basiradial pore opens on the inner edge of the naked portion.¹⁷ Lateral line with an inconspicuous curve in the pectoral region, continued to the

¹⁶ One example (I. 15/2491) is exceptionally short and deep, its depth being 2.15 in its length.

¹⁷ Günther, in his diagnosis of the genus, writes—"Dorsal and anal rays scaly." However this may be with *P. marmoratus*, it is certainly incorrect as regards *P. pavoninus* and *P. hedleyi*.



PARDACHIRUS HEDLEYI Ogilby. Nat. Size.

Phyllis Clarke, del.

extremity of the caudal fin. On the right side it is extended forward to the preopercular region, and just before its termination throws off two short branches, directed upwards and downwards.

Dorsal fin with 65 to 74, anal with 50 to 55 rays, all of which, except a few short ones in front and behind, are divided; the longest rays are inserted about the commencement of the last quarter of the fins (D. 48th to 53rd, A. 35th to 39th), and the latter fin is a little the higher. Caudal fin broadly rounded, with 18 rays, its length 5 to 5.75 in that of the body. Each ventral with 5 branched rays.

Vinaceous brown, the head, body, and fins profusely ornamented with lavender-gray dark-edged spots of variable shape and size, which sometimes contain one or more darker dots, but are more commonly plain; usually three series—dorsal, median, and ventral—of large suffused blackish spots on the body; these, however, may be broken up into more numerous and clearly defined spots scattered irregularly over the side; head usually without black spots. Lower surface yellowish white. (Named after my friend Charles Hedley, the premier conchologist of Australia.)

Described from 9 examples, measuring between 118 and 152 millim.; 8 of these were taken in Port Jackson, the ninth in Moreton Bay.

Historical:—The earliest notice which we have of this fish is from the pen of Count Castelnau, who introduced it into his list of Port Jackson fishes, published in 1879, confounding it, however, with the preceding species. Castelnau's error was perpetuated by Macleay, Ogilby, and subsequent writers on the ichthyology of New South Wales, and is only now corrected, because it became necessary for me to make a thorough examination of the peacock soles of Eastern Australia for the purposes of this work, when the differences between the two species were at once apparent.

Habits:—This pretty little sole is common in suitable localities in Port Jackson, and probably along the greater part of the coastline of New South Wales and South Queensland, at least as far north as Moreton Bay. It is, however, little known anywhere along the stretch of coast referred to, escaping observation because the smallness of its mouth precludes it from taking any hook in ordinary use. If, however, the otter trawl were more generally employed, we should possibly find that a fair supply of this delicious little fish could be obtained for the market.¹⁸ Like its congeners this sole is entirely an inhabitant of the litoral zone, preferring such localities as have a sandy, mixed sandy and muddy, or gravelly bottom in from 3 to 7 fathoms water. Stead writes of it as follows:—"This beautifully ornamented species is not of present economic importance. It appears to be purely an estuarine fish, affecting sandy bottoms, and occurring in the waters along the greater part of our coastline. It is rarely seen in our markets, and is not often captured."

Uses:—A most delicious morsel.

¹⁸ This at least we found to be the case in Port Jackson when, some thirty years ago, it was the weekly custom of the Australian Museum staff, under the leadership of Dr. Ramsay, to spend Saturday down the harbor with otter trawl and dredge. By this means the local fauna was enriched by many scarce and not a few new species. Occasionally as many as a dozen specimens of *Pardachirus* were caught, Rose Bay being a favorite ground. This custom might well be initiated here with much advantage to our own Museum.

Food.—Remains of small crustaceans, mollusks, and a worm were found in the stomachs of two specimens examined.

Range.—Coasts of New South Wales and Southern Queensland. Besides Port Jackson and Moreton Bay the only locality from which I have seen this sole is Byron Bay, N.S.W., where the "Endeavour" trawled a specimen when *en route* to Moreton Bay in July, 1910.

PART III.—CARANGIDÆ (No. 2).

SUBFAMILY TRACHINOTINÆ.

THE SWALLOWTAILS.

Litoral carangoid fishes, inhabiting all warm seas, distinguished by the unarméd tail, the long anal fin¹ which is similar to the soft dorsal and exceeds in length the abdominal region, and the short non-falcate pectoral fins. Genera 5; species about 28.

As is the case with all nearly related forms the swallowtails or pámpanos,² to use a convenient general term, are partially migratory, though their movements are for the most part regulated by the abundance or scarcity of the food supply. That climatic conditions, however, influence to some extent their periodical migrations, seems to be indicated by the fact that our common swallowtail (*T. bolla*),³ though present in our waters at all seasons of the year, visits our shores in large schools during the winter months. These fishes presumably come from the south, since they are usually associated with the shoals of "sea mullet" (*Mugil cephalus dobula*) at that season coasting northwards to their breeding-grounds. The pámpanos swim high in the water and, through the instrumentality of their powerful caudal fin, are able not only to move with extreme rapidity, but also to turn sharply on their course with the minimum loss of time and speed. They are, therefore, very destructive to the young of other fishes, which form a great part of their food, along with swimming crabs, squid, and certain mollusks which they seek among the breakers.

Opinions vary greatly as to the gastronomic value of these fishes, but modern popular opinion apparently agrees in regarding the majority of the species as being dry and insipid. There are, however, some notable exceptions, as for instance *Trachinotus carolinus*,⁴ the "common pámpano" of the Southern Atlantic and Gulf States of North America, which Jordan and Evermann characterise as "the most valued food-fish in our southern waters, its flesh rich,

¹ Except in *Campogramma* Regan, in which the anal is much shorter than the dorsal and about as long as the abdominal region (i.e. the space between the origin of the ventrals and the soft anal), and the pectorals are subfalciform.

² The dictionaries spell this word "pompano," but I have followed Jordan & Evermann (Fish. North & Mid. America, pt. i, p. 944) in adopting the above as the more classical orthography. Cuvier & Valenciennes too employed this reading, having named the species, which we now know as *Trachinotus carolinus*, *T. pampanus*.

³ Mem. Queensl. Mus., iii, pp. 93-98.

⁴ *Gasterosteus carolinus* Linneus, Syst. Nat., ed. 12, p. 490.

firm, and delicate, superior to all others of its genus and family";⁵ again Jordan "The true pámpano is one of the finest of all food-fishes, ranking with the Spanish mackerel, and to be cooked in the same way, only by broiling. The flesh is white, firm, and flaky, with a moderate amount of delicate oil."⁶ Referring to *T. palometa*⁷ Valenciennes⁸ states that "its flesh is excellent," but quotes l'Herminier to the effect that it is only good when in condition, but at other times is regarded with suspicion"; a remark which might with equal truth be made about many other fishes. Jordan and Evermann speak of it as "not highly valued,"⁹ of *T. rhodopus*¹⁰ as "not much valued as food," of *T. falcatus*,¹¹ with which our snub-nosed swallowtail is very closely allied, as being "less valuable than its congener *carolinus*."¹² Crossing the Atlantic we find Valenciennes, in his account of *Lichia amia*,¹³ quoting Risso as saying "this fish is highly esteemed and in great request,"¹⁴ while of *Campogramma vadiago*¹⁵ the same author, quoting Rondeletius, reports that "the flesh is rich and well flavored, but tough."¹⁶

Nothing definite is known as to the breeding habits of these fishes, nor have I ever handled a specimen containing spawn in any stage of development. We may, however, fairly assume that, as with all kindred fishes, the ova are shed in the open sea at some distance from the shore and are pelagic.

The swallowtails are of little value from a sportsman's point of view, nevertheless when, as occasionally happens, a large one is hooked in the surf, its great strength, rapidity of movement, and sudden twists and turns are calculated to elicit the highest skill of the angler.

Synopsis of the Trachinotine Genera.

a¹. Maxillary with supplemental bone.

b¹. Teeth in jaws conical and uniserial; anal fin shorter than soft dorsal CAMPOGRAMMA,¹⁷

b². Teeth in jaws in villiform bands; anal fin as long as soft dorsal HYPODIS,¹⁸

a². Maxillary without supplemental bone.

c¹. Thoracic region not cultrate; dorsal and anal fins falciform TRACHINOTUS.

c². Thoracic region cultrate; dorsal and anal fins not falciform ZALOCYS.¹⁹

⁵ Fish. North & Mid. America, pt. i, p. 944.

⁶ Guide to the Study of Fishes, ii, p. 276.

⁷ A substitute name given by Regan (Ann. & Mag. Nat. Hist. (7) xii, p. 349) to *Chætodon glaucus* Bloch (Ausl. Fisch., iv, 1787, pl. ccx), the specific name being antedated by *Scomber glaucus* Linnæus (Syst. Nat., ed. 10, 1758, p. 298), the two species being congeneric.

⁸ Hist. Nat. Poiss., xiii, p. 407.

⁹ Ibid., p. 941.

¹⁰ Gill, Proc. Acad. Nat. Sci. Phila., 1863, p. 85.

¹¹ *Labrus falcatus* Linnæus, ibid., p. 284.

¹² Ibid., p. 942.

¹³ *Scomber amia* Linnæus, ibid., p. 299.

¹⁴ Ibid., p. 357.

¹⁵ *Centronotus vadiago* Risso, Ichth. Nice, p. 196.

¹⁶ Ibid., p. 365.

¹⁷ *Campogramma* Regan, Ann. & Mag. Nat. Hist. (7) xii, 1903, p. 3. Type, *Centronotus vadiago* Risso 1810. Range, Mediterranean and the neighboring parts of the Atlantic. Monotypic.

¹⁸ *Hypodis* Rafinesque, Anal. Nat., 1815, p. —. Type, *Scomber amia* Linnæus 1758. Range, Mediterranean and Eastern Atlantic. Monotypic.

¹⁹ *Zalocys* Jordan & McGregor, Rep. U. S. Fisher. Comm., 1899, p. 276. Type, *Z. stilbe*, idd., ibid., p. 277. Range, Eastern Tropical Pacific (Revillagigidos). Monotypic.

TRACHINOTUS Lacépède.

Trachinotus Lacépède, Hist. Nat. Poiss., iii, 1802, p. 79 (*falcatus*); Jordan & Evermann, Fish.

North & Mid. Amer., pt. i, 1896, p. 939.

Cæsiomorus Lacépède, ibid., p. 95 (*bailloni*).

Acanthinion Lacépède, ibid., iv, 1802, p. 500 (*rhomboides* = *falcatus*).

Baillonus Rafinesque, Anal. Nat., 1815 (*bailloni*).

Doliodon Girard, Proc. Acad. Nat. Sci. Phila., 1858, p. 168 (*carolinus*).

Bothrolæmus Holbrook, Ichth. South Carolina, 1860, p. 82 (*pampanus* = *carolinus*).

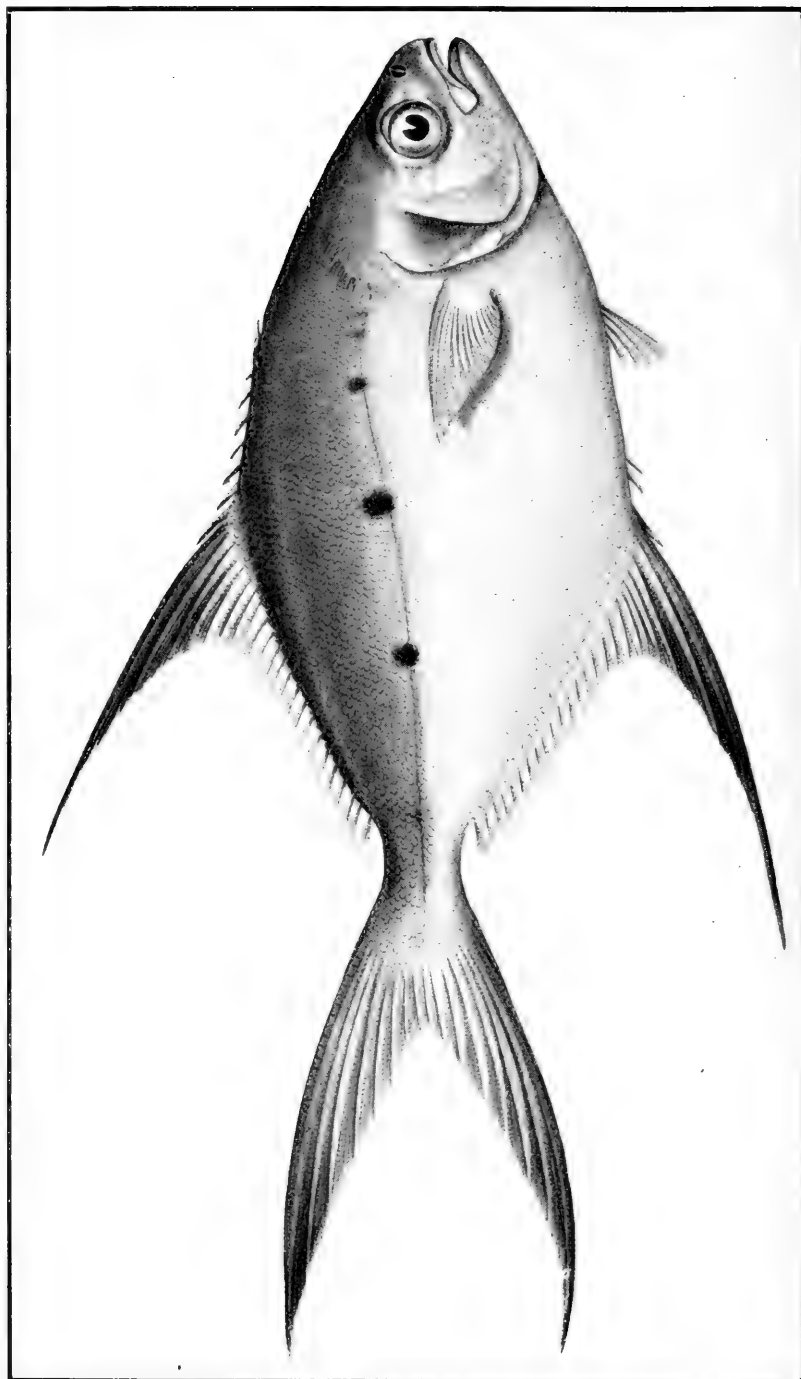
Trachynotus Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 480; amended orthography. Pre-occupied in *Colcoptera* by Latreille in 1829 and in *Hymenoptera* by Gray 1829.

"THE SWALLOWTAILS."

Body ovate or elevated, more or less strongly compressed; abdomen rounded, shorter than the anal fin. Scales small, smooth, and adherent, covering the breast. Lateral line complete, straight or but little curved, sometimes locally undulous. Head rather small, with moderate, truncate or rounded snout, scaleless or partially scaly. Mouth protractile, with rather small, horizontal or slightly oblique cleft, the jaws subequal; maxillary without distinct supplemental bone. Jaws, vomer, and palatines with bands of villiform teeth, disappearing usually with age. Opercles entire in the adult, the young with strong preopercular armature. Two dorsal fins, the first of 6 or 7 spines with an anterior procumbent spine; in the young the former are connected by membrane, but with advancing age this gradually disappears leaving each free, while in very old examples even these are absorbed; soft dorsal and anal fins similar in form and size, the anterior rays in each more or less produced; two stout semi-detached spines in front of the anal, disappearing with age. Caudal deeply forked. Pectoral small, with 17 or 18 rays, the upper the longest. Ventrals small and close together, with 15 rays, inserted below or behind the base of the pectorals. Gill-openings wide; gill-membranes separate, free from the isthmus; branchiostegals seven; pseudobranchiæ present, concealed in old examples; gill-rakers in moderate number, well developed or short; pharyngeal bones strongly armed in the young, the teeth caducous; third upper pair and lower pair closely in contact but not united. (τραχίς, rough; ὠτός, back.)

Carangoid fishes of moderate or large size, inhabiting all warm seas; about 25 valid species.

Remarkable changes of form and structure take place in these fishes between youth and age. Very young examples have the angle of the preopercle armed with 3 strong spines, and the limbs, both vertical and horizontal, more feebly denticulated; the jaws, vomer, palatines, and pharyngeals toothed; and the spinous dorsal developed as a normal fin. In the second, or *Doliodon*, stage the preopercular spines have been absorbed into the body of the bone, and the relative values of the spinous and soft dorsal fins undergo a reciprocal change, the decrease in the former being counterbalanced by a corresponding increase in the latter. When the half-grown, or *Trachinotus*, stage has been reached, the connecting membrane between the dorsal spines has disappeared, and the functional value of the teeth has perceptibly diminished. In the last, *Bothrolæmus*, stage the teeth both of the mouth and the gullet, the pseudo-branchiæ, and the spinous dorsal and anal fins have quite disappeared, while the lobes of the soft dorsal, anal, and caudal fins have attained their maximum development.



TRACHINOTUS BAILLONI (Lacépède). ♂ Nat. Size.

Phyllis Clarke, del.

*Synopsis of Subgenera and Species.**Trachinotus* :—

*a*¹. Body elevated, its depth half or more than half its length ; snout high, anteriorly vertical ; upper jaw the longer ; gill-rakers short and stout.

*b*¹. Dorsal fin with 18 or 19, anal with 17 soft rays ; sides immaculate .. *1. ovatus.*

Cæsiomorus :—

*a*². Body ovate, its depth less than half its length ; snout low, anteriorly rounded ; gill-rakers longer and more slender.

*c*¹. Dorsal with 23 or more, anal with 21 or more soft rays.

*d*¹. Snout slightly gibbous anteriorly ; caudal fin longer ; ventral shorter .. *bailloni.*

*d*². Snout pointed anteriorly ; caudal fin shorter ; ventral longer *botla.*

*c*². Dorsal with 20 or less, anal with 17 or less soft rays ; snout gibbous .. *anak.*

TRACHINOTUS BAILLONI (Lacépède).

(Plate XVIII.)

Cæsiomorus bailloni Lacépède, Hist. Nat. Poiss., iii, 1802, p. 93, pl. iii, fig. 1 (after Commerçon's figure).

Cæsiomorus quadripunctatus Rüppell, Atlas Fisch. Roth. Meer., 1828, p. 90, pl. xxiv, fig. 1.

Trachinotus bailloni Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 1831, p. 434 (after Commerçon's MSS.) ; Bleeker, Nat. Tijds., Nederl. Ind., iii, 1852, p. 237 ; id., Verh. Batav. Gen., xxiv, 1852, Makreel., p. 46 ; id., Nat. Tijds. Nederl. Ind., x, 1856, p. 469 ; id., ibid., xii, 1857, p. 214 ; id., ibid., xiii, 1857, p. 419 ; id., ibid., xvii, 1859, p. 146 ; id., Act. Soc. Sci. Indo-Neerl., viii, 1860, Sumatra. p. 2 ; id., ibid., Celebes, p. 38 ; id., Nat. Tijds. Nederl. Ind., xxii, 1861, p. 65 ; id., Versl. Akad. Amsterdam, xii, 1861, p. 74 ; Steindachner, Denk. Akad. Wien., 1902, p. 22 ; Waite, Rec. Austr. Mus., v, 1903, p. 25 ; id., ibid., 1904, p. 200 ; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 235 ; Jordan & Starks, Proc. U. S. Nat. Mus., xxxii, 1907, p. 495 ; Jordan & Richardson, Mem. Carnegie Mus., iv, pt. 4, 1909, p. 180 ; id., Check-List Fish. Philipp Archip., 1910, p. 21 ; Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 271, pl. ii, fig. 1 ; McCulloch, Rec. W. Austr. Mus., i, pt. 3, 1914, p. 223.

Trachinotus quadripunctatus Cuvier & Valenciennes, ibid., p. 434.

Trachynotus quadripunctatus Cantor, Catal. Malay. Fish., 1850, p. 122.

Trachynotus bailloni Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 484 (descr. & synonym. in part) ; Bleeker, Versl. Akad. Amsterdam, xiv, 1862, p. 109 ; id., Nederl. Tijds. Dierk., i, 1862, p. 242 ; id., Versl. Akad. Amsterdam, xvi, 1864, p. 260 ; id., Nederl. Tijds. Dierk., ii, 1865, pp. 99, 174, 191, 289 ; Playfair, Proc. Zool. Soc. London, 1867, p. 861 ; Klunzinger, Verh. zool.-bot. Ges. Wien., 1871, p. 449 ; Bleeker, in Pollen & van Dam, Faun. Madagascar, pt. 4, 1875, Poiss., p. 98 ; Day, Fish. India, pt. 2, 1876, p. 233, pl. lia, fig. 4 ; Peters, Mon. Akad. Berlin, 1876, pp. 440, 836 ; Bleeker, Verh. Akad. Amsterdam, xviii, 1879, Ile Maurice p. 18 ; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 545 (descr. after Günther ; not localities) ; Boulenger, Proc. Zool. Soc. London, 1887, p. 661 ; Waite, Mem. Austr. Mus., iii, pt. 8, 1897, p. 190.

Trachynotus bailloni Day, Proc. Zool. Soc. London, 1865, p. 25 ; id., Fish. Malabar, 1865, p. 98 ; Günther, Fisch. d. Sudsee, pt. 4, 1876, p. 139.

Trachinotus oblongus Kendall & Goldsborough, ibid., p. 272, pl. i. Not of Cuvier & Valenciennes 1831.

BLACK-SPOTTED SWALLOWTAIL.

Type localities :—Fort Dauphin, Madagascar (*C. bailloni*).

Red Sea at Massawa (*C. quadripunctatus*).

Body ovate and strongly compressed, the ventral contour rather more curved than the dorsal, which is linear and moderately acclivous from the forehead to the nape, beyond which the acclivity is much more gentle to the soft dorsal ; ventral contour moderately convex from the chin to the anal with

a slight emargination at the isthmus; width of body 4 in its depth, which is 2.3 to 2.45 in its length and five ninths to two thirds more than the length of the head; abdominal region moderate, 1.67 in the length of the anal; caudal peduncle about three fifths longer than deep, its least depth three tenths more than the eye-diameter. Head rather small, its length 3.8 in that of the body, its width 1.8 in its depth, which is 1.1 in its length; cranio-nuchal keel little developed. Snout moderate and rounded, its upper profile linear and oblique, with a slight prefrontal prominence, its length one eighth more than the eye-diameter, which is 3.85 to 4 in the length of the head; adipose lid little developed; interorbital region elevated and sharply rounded, its width three eighths more than the eye-diameter. Jaws equal; maxillary extending to below the anterior border of the pupil; its length 2.75 in that of the head, the width of its concave distal extremity two thirds more than its distance from the eye and 2.55 in the eye-diameter. Preopercle with rounded angle, the membranous border feebly crenulate, the hinder limb vertical.

Both jaws with a band of villiform teeth; similar teeth on the vomer and palatines; pterygoids and tongue smooth.

Scales small and rounded on the trunk, becoming gradually larger on the tail; cheeks and postorbital region scaly; rest of head and nuchal ridge naked. Lateral line with a feeble curve anteriorly, thence straight to the caudal fin, the pores about 95.

Dorsal fin with vi, i 23 or 24 rays; procumbent spine strong and exposed; spines short and separate, graduated, the last 1.4 in the eye-diameter. Soft dorsal originating one fifth nearer to the root of the caudal than to the tip of the snout, the anterior rays produced, the first the longest, varying from 2.25 to 3.2 in the body-length, and extending when depressed to the base of the 19th ray or the middle of the caudal peduncle; last ray not produced. Caudal fin very long and deeply forked, the lobes pointed, the upper rather the longer, 1.95 to 2.15 in the length of the body. Anal fin with ii, i 23 rays, originating a little in advance of the soft dorsal, its lobe as high as that of the dorsal. Pectoral pointed, with 17 rays, its length 5.5 in that of the body; 4th ray longest, extending to a little beyond the level of the vent. Ventral small, inserted slightly behind the pectoral-base, its length 1.75 to 1.85 in that of the pectoral and 9 to 9.75 in that of the body; 1st and 2nd rays equal, reaching to the vent.

Gill-rakers rather short and moderately strong, 7+16 on the anterior arch, the longest 8.2 in the length of the head and as long as the gill-fringes. Vent midway between the origins of the ventrals and anal.

Upper surface of head and body greenish gray, shading through the silver-gray of the sides to the milk-white of the lower surface; a series of four round spots on each side upon the lateral line; the first faint, situated upon the curve, below the procumbent spine; the second larger and darker, below the 3rd and 4th spines; the third rather larger, below the anterior dorsal rays; the last much smaller and fainter, below the middle of the soft dorsal.²⁰ Dorsal and anal lobes and the outer edge and tip of the upper caudal lobe blackish. (Named after L. A. J. Baillon, an early French naturalist.)

Described from one of two specimens collected by Mr. McCulloch at Murray Island, these being at present the only authentic examples known from Australian

²⁰ On the left side the arrangement of the spots is similar, but all are appreciably further back.

waters. On this account the gift of one for the purpose of this work by the authorities of the Australian Museum is the more commendable, and our thanks proportionately the greater.

Historical.—The earliest published notice of this species is that of Lacépède, whose description was taken from a drawing by Commerçon, which he also reproduced. This specimen was captured at Fort Dauphin, Madagascar as we learn from Valenciennes who, more fortunate than his predecessor, was able to draw up his description direct from certain Commerçonian manuscripts, which were not available to Lacépède. Meanwhile, however, under the name of *Cæsiomorus quadripunctatus*, Rüppell had described and figured the same species from the port of Massawa on the Abyssinian littoral of the Red Sea. Under this specific name Valenciennes records it separately from examples obtained by Dussumier in the Seychelles Archipelago, but he is careful to point out its close resemblance to *Trachinotus bailloni*. After an interval of nearly twenty years we find our fish in evidence as occurring in the "Sea of Pinang"²¹ where, according to Cantor, "a single individual was taken in June, 1845, while unusually strong southerly winds prevailed." His specimen measured 197 millim. and was, so the local fishermen asserted, "of very rare occurrence." A couple of years later Bleeker announced the receipt of specimens from Ceram, which eventually proved to be the most easterly point from which he received it, and from that time on records of its occurrence in various islands of the Malay Archipelago became frequent. The publication of the British Museum Catalogue of Fishes in 1860 provided an important increase in the eastern range of the species, Dr. Günther being in a position to announce that the National Museum had acquired, through the medium of the Museum of Economic Geology, a fine specimen from Tanna, one of the larger islands in the southern half of the New Hebrides Group.²² In 1865 Bleeker enlarged its distribution northward to the Coast of Siam and Day recorded it from Cochin on the Malabar Coast of India. Day's record is, however, more or less impaired by his inability at that time to distinguish between these two closely allied species; his synonymy (Fishes of Malabar) indubitably includes both species, but his description of the position of the lateral spots, i.e.—"on the lateral line there are four or five large black spots more or less distant, the first one opposite the end of the pectoral," as undoubtedly refers to this species. His account of the habits might have been penned as a description of those of *T. botla* as we know them on our own shores, and doubtless applies with equal justice to either species. He writes—"This fish is uncommon, and is usually captured by cast-nets in the surf, where the fishermen assert it always swims; it is very rarely taken in the deep sea and never in the rivers." Eleven years later, when the second part of his Fishes of India was produced, we find that he has altered his opinion as to the validity of the two species, of both of which he gives a recognisable figure and description. Leaving out the question of coloration he relies principally for the separation of the species—on the smaller number of anal rays, the longer ventral fins, and the shorter caudal fin in *T. botla* than in *T. bailloni*. If we attempt a general analysis of these three characters from the specimens to which we have access we

²¹ The island of Pulo Pinang or Prince of Wales Island, to which this refers, lies off the West Coast of the Malay Peninsula in lat. 5° N.

²² Since Jordan & Seale (Fishes of Samoa, p. 235) deny by implication the presence of *T. russellii* (= *botla*) in any of the islands of the South Pacific, it follows that in all probability this is a true *T. bailloni*.

find that none of the three is of any differential value, but if on the contrary we select from each species a single example of practically the same size we find that, while the first character should be discarded as useless, the other two hold good absolutely. For instance, comparing a 148 millim. *bolla* with a 155 millim.²³ *bailloni*, we see that these characters compare as follow—Length of ventral fin to body-length, *T. bolla* 7.9, *T. bailloni* 9.55; length of caudal fin in same, *T. bolla* 2.5, *T. bailloni* 2.15. So far, therefore, as this method of comparison goes, Day's conclusions are fully justified.²⁴ In the interval between the publication of these two works, Playfair in 1867 had obtained our species at the Seychelles. In 1876 Günther, still persisting in his refusal to recognise the distinction between the two species, again makes a notable addition to the eastern range of this trachinote, recording it from Samoa and even, on the authority of Garrett, as far east as the Society Islands, while Peters in the same year added New Britain to the list. Bleeker, in one of the last papers of his busy life, records it from Mauritius, and Boulenger some years later received it from Maskat on the Persian Gulf, neither of these localities, however, adding anything to its range. We next hear of it through the Expedition sent out in 1896 by the Royal Society of London to Funafuti, where Hedley succeeded in collecting for the Australian Museum a very young example, measuring but 85 millim. in total length, as recorded by Waite. This record is interesting as indicating a new radial of range, stretching outwards about one thousand miles north-eastwards from Tanna. Waite was also fortunate in obtaining a large example, measuring 560 millim. over all, from Lord Howe Island through the kind offices of Mr. W. S. Thompson; both of our spotted swallowtails are, therefore, visitants to the "Madeira of the Pacific." Previous to this Steindachner had added Socotra and the coast of South Arabia to the list of known localities. Jordan and Seale had nothing new to advance as to its Pacific distribution, but the senior author in conjunction with Starks obtained a single specimen "a little deeper in form than is usual in this species" from the Riu Kiu Archipelago (Loo Choo Islands), which up to the present time constitutes the northern limit of its distribution. Subsequently Formosa and the Philippines were added by Jordan and Richardson. In a paper published in 1911,²⁵ dealing with the Shore Fishes collected by the Albatross Expedition to the Tropical Pacific in 1899-1900 Kendall and Goldsborough attempt to review the status of the Indo-Pacific spotted trachinotes. These authors commence with a criticism of Day's figure of *T. bailloni* as regards the extension of the maxillary; this criticism is fully justified, but the illustrations in the "Fishes of India" are so frequently inaccurate in matters of detail, that it is questionable whether this particular inaccuracy, neutralised as it is by a correct description, merits the prominence given to it. The authors proceed then to discuss the length of the vertical fin lobes, a character on which far too much importance is placed, for the variation in this respect is very great even in a single species and, as I have shown before,²⁶ is not contingent on the size or age of the individual, and is, therefore, of no structural value. The measurements given by them are also most confusing; in some cases those of the lobes are given "in length," in others "in base of fin," so that there is no standard of comparison, and, therefore, no

²³ From tip of snout to root of caudal fin.

²⁴ Fishes of Malabar 1865 and Fishes of India 1876.

²⁵ I was unfortunately unaware of this paper when I wrote the article on *T. bolla* in last year's Memoirs.

²⁶ Memoirs Queensl. Mus., iii, p. 96.

general comparison between specimens of different sizes is possible. Again, the measurements given "in length" would make it appear at a casual glance that the lobes are excessively short, in fact practically non-existent, but on turning to the figure (of *T. oblongus*) we find that the caudal fin is included in the "length" measurement, a method of computation which has been discarded for so many years by all reputable ichthyologists, that it is necessary here to call attention to its revival in a modern work. Measured in the ordinary manner, from the tip of the snout to the root of the caudal, their figure agrees very well with my example of *T. bailloni*, in the synonymy of which their *T. oblongus* should be placed, while their *T. quadripunctatus* should be relegated to *T. botla*. Reverting for a moment to these authors' criticism of the inaccurate representation of the maxillary in Day's figure, it is somewhat disconcerting to find that while they write of that bone in *T. oblongus* as "maxillary short, reaching front of eye," their artist has depicted it as reaching well-nigh below the middle of the eye, thus reversing their own proposition.

Uses.—The only notice which I can find, dealing with this important phase of the subject, is that by Valenciennes, under *Trachinotus quadripunctatus*, where he writes in reference to the Seychelles islanders "it is highly esteemed and is moderately abundant throughout the year." Doubtless my remarks under *T. botla* would apply with equal justice to this fish, as also those regarding their food.

Range.—The range of the Black-spotted Swallowtail is much wider than that of its congener and near ally *T. botla*, being roughly from Madagascar, Mauritius, the Seychelles, and the Red Sea, through the Indian and Malayan seas eastward to the Ellice and Society Islands and northward to the Riu Kiu Group. In Australian waters the records, as before mentioned, are very unsatisfactory, owing to the association of the two allied species—*botla* and *bailloni*—under the latter name by Dr. Günther, whose example was followed by all the earlier Australian writers. Two records may, however, be selected, the one as certainly, the other as probably, authentic. The first relates to the specimens collected by McCulloch at Murray Island, the second to that recorded by Waite from Lord Howe Island; the latter is unfortunately unavailable for re-examination. Eastward of Australia it has been specifically reported from—Lord Howe Island (*Waite*), New Britain (*Peters*), New Hebrides, Samoa, and the Society Group (*Günther*), and the Ellice Islands (*Waite*). It may, therefore, be regarded as of general distribution among the greater number if not all of the South Sea Islands. Turning westward from thence we first note the Murray Island record (*McCulloch*), and next arrive at the Austro-Malayan section of the Archipelago, whence it has been recorded from Ceram, Amboina, Batchian, Obi, and Celebes (*Bleeker*), while the Indo-Malayan section yielded to the same indefatigable collector specimens from Bali, Java, Nias, and Sumatra. Northwards we find it extending through the Philippines and Formosa (*Jordan & Richardson*) to the Riu Kiu Islands (*Jordan & Starks*), but so far it does not seem to have reached Japan, nor to have been met with on the mainland of China. Westward from the Malay Archipelago it recurs at Pulo Pinang (*Cantor*), Siam (*Bleeker*), and the Indian Peninsula (*Day*), onward through the Persian Gulf (*Boulenger*) to Socotra and South Arabia (*Steindachner*), which lie at the gateways of the Red Sea, one of the original type-localities (*Rüppell*). Southwards in the Indian Ocean it has been recorded from the Seychelles (*Valenciennes*), Mauritius (*Bleeker*), and Madagascar (*Commerçon*), but I can nowhere find any notice of its occurrence on the East African littoral.

Dimensions:—Day obtained a specimen measuring 483 millim. on the Indian Coast, but Waite's Lord Howe Island record of 559 millim. is, I believe, the highest as yet published.

Illustration:—Through the kindness of the Trustees of the Australian Museum our illustration has been taken from the larger and more perfect specimen taken by Mr. McCulloch at Murray Island.

TRACHINOTUS OVATUS (Linnaeus).

Pesque-pampus Renard, Poiss. Moluques, i, 1718, pl. xxvii, fig. 151.

Ikan-botoe Valentyn, Amboina, iii, 1724, p. 386, fig. 118.

Gasterosteus ovatus Linnaeus, Syst. Nat., ed. 10, i, 1758, p. 296; Bonnaterre, Encycl. Méth., Ichth. 1788, p. 137.

Scomber falcatus Forskal, Deser. Anim., 1775, p. 57; Bonnaterre; *ibid.*, p. 142. Not *Labrus falcatus* Linnaeus, which is also a *Trachinotus*.

Trachinotus falcatus Lacépède, Hist. Nat. Poiss., iii, 1802, p. 79; Rüppell, Atlas Fisch. Roth. Meer., 1828, p. 89; Cuvier & Valenciennes, Hist. Nat. Poiss., viii, 1831, p. 430. Not *Labrus falcatus* Linnaeus.

Casiomorus blochii Lacépède, *ibid.*, p. 95, pl. iii, fig. 2 (after Commerçon's figure).

Centronotus ovalis Lacépède, *ibid.*, pp. 309, 316.

Mookalee Parah Russell, Fish. Vizagapatam, ii, 1803, p. 39, pl. cliv.

Trachinotus mookalee Cuvier & Valenciennes, *ibid.*, p. 423; Bleeker, Nat. en Geneesk. Arch. Nederl. Ind., ii, 1845, p. 516; *id.*, Verh. Batav. Gen., xxiii, 1850, Midd.-en Oost-Java, p. 8; Jerdon, Madras Journ. Lit. & Sci., 1851, p. 136; Bleeker, Nat. Tijds. Nederl. Ind., iii, 1852, pp. 412, 445; *id.*, Verh. Batav. Gen., xxiv, 1852, Makreel., p. 47; *id.*, *ibid.*, xxv, 1853, Bengal, p. 44; *id.*, Nat. Tijds. Nederl. Ind., xv, 1858, pp. 223, 459; *id.*, Aet. Soc. Sci. Indo-Ncerl., v, 1858, Borneo, p. 2; *id.*, *ibid.*, viii, 1860, Sumatra, p. 28; *id.*, *ibid.*, Borneo, p. 13; *id.*, *ibid.*, Celebes, p. 38.

Trachinotus blochii Cuvier & Valenciennes, *ibid.*, p. 429 (after Commerçon's MSS.); Bleeker, Versl. Akad. Amsterdam, xii, 1861, pp. 52, 74.

Trachinotus affinis Cuvier & Valenciennes, *ibid.*, p. 428.

Trachinotus falciger Cuvier & Valenciennes, *ibid.*; Bleeker, Nat. en Geneesk. Arch. Nederl. Ind., ii, 1845, p. 516.

Trachinotus drepanis Cuvier & Valenciennes, *ibid.*, p. 429.

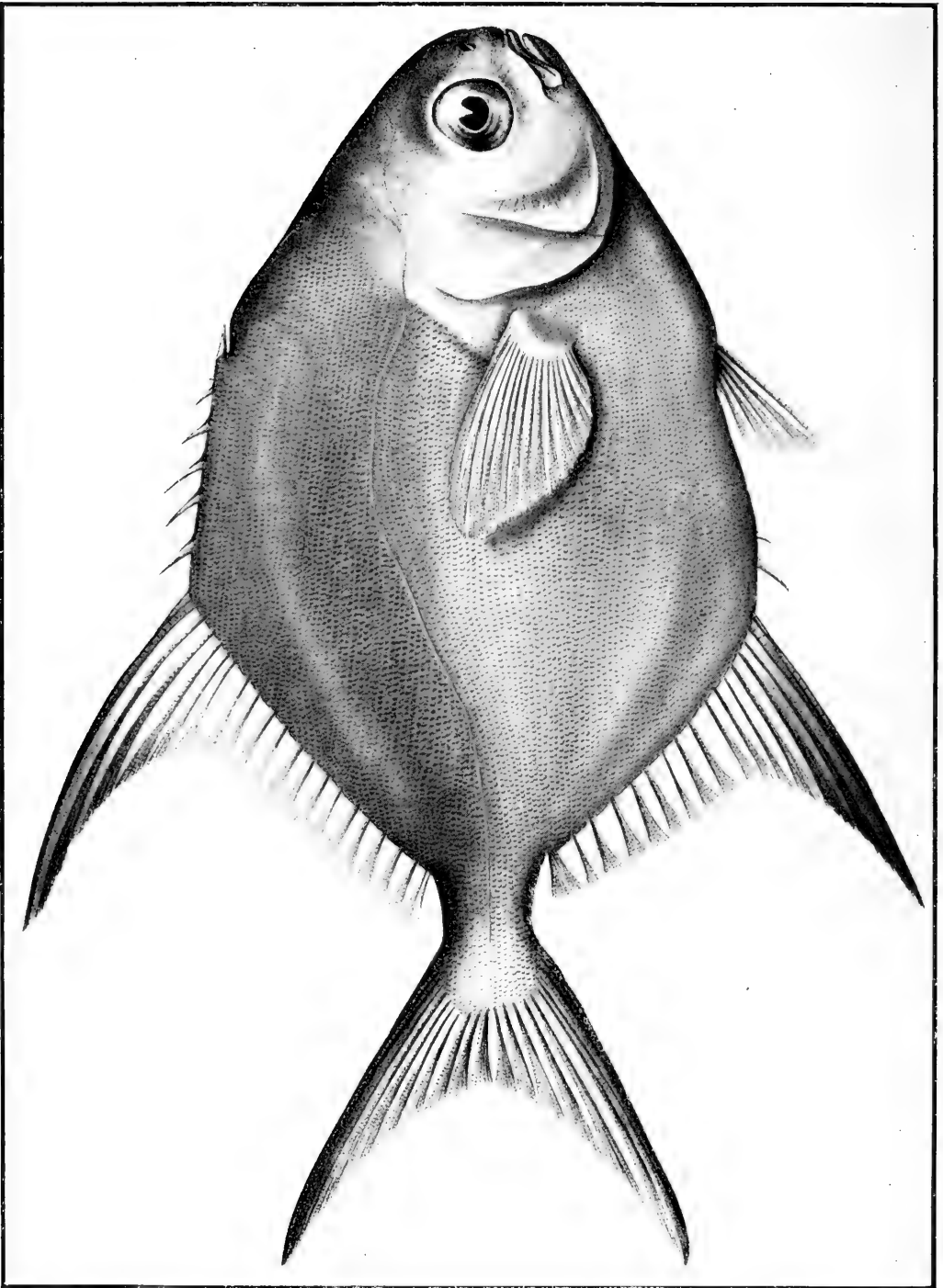
Trachinotus auratus Richardson, Rep. Ichth. China & Japan, 1845, p. 270.

Trachynotus mookalee Cantor, Catal. Malay. Fish., 1850, p. 120.

Trachynotus ovatus Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 481; Bleeker, Nederl. Tijds. Dierk., i, 1863, p. 242; *id.*, *ibid.*, ii, 1865, p. 289; Day, Proc. Zool. Soc. London, 1865, p. 25; *id.*, Fish. Malabar, 1865, p. 97; Kner, Reise Novara, Fisch., pt. 2, 1865, p. 164; Playfair, Proc. Zool. Soc. London, 1867, p. 861; Steindachner, Sitz. Akad. Wien, lx, 1869, p. 709; Day, Proc. Zool. Soc. London, 1870, p. 689; Klunzinger, Verh. zool.-bot. Ges. Wien, 1871, p. 449; Bleeker, Nederl. Tijds. Dierk., 1873, p. 132; *id.*, in Pollen & van Dam, Faun. Madagascar, pt. 4, 1875, Poiss. p. 98; Day, Fish. India, pt. 2, 1876, p. 234, pl. lib, fig. 2; Günther, Fisch. d. Sudsee, pt. 4, 1876, p. 139; Alleyne & Macleay, Proc. Linn. Soc. N. S. Wales, i, 1877, p. 329; Klunzinger, Sitz. Akad. Wien, lxxx, i, 1879; Günther, Zool. Challenger, i, 1880, Shore Fishes, p. 44; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 545 (after Günther); *id.*, *ibid.*, vii, 1882, p. 359; Woods, Fish. & Fisher. N. S. Wales, 1882, p. 17; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 27.

Trachinotus ovatus Steindachner, Denk. Akad. Wien, 1902, p. 22; Waite, Synops. Fish. N. S. Wales, 1904, p. 41; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 235; Stead, Edib. Fish. N. S. Wales, 1908, p. 93; Jordan & Richardson, Mem. Carnegie Mus., iv, 1909, p. 180; Kendall & Goldsborough, Mem. Mus. Comp. Zool., xxvi, 1911, p. 271.²⁷

²⁷ Jordan & Gilbert (Proc. U.S. Nat. Mus., v, 1882, p. 375) record the species from Western America, but I can not find any mention of this reference in the Fishes of North and Middle America; possibly it should be placed in the synonymy of the closely allied *T. culveri*.



TRACHINOTUS OVATUS (Linnaeus). 1½ Nat. Size.

Phyllis Clarke, del.

SNUB-NOSED SWALLOWTAIL.

Snub-nosed Dart (*Stead*).

(Plate XIX.)

Type localities:—"In Asia" (*G. ovatus*).Red Sea at Jeddah (*S. falcatus*).Fort Dauphin, Madagascar (*C. blochii*).Pondicherry (*T. mookalee*).Malabar Coast (*T. affinis*).Malabar Coast (*T. falciger*).Seychelles (*T. drepanis*).

Body deeply ovate and strongly compressed, the dorsal contour much more arched than the ventral; the former linear or feebly convex and strongly acclivous from above the nostrils to the tip of the procumbent spine, the latter linear and declivous from the chin to the isthmus thence convex to the vent, which is situated in a slight concavity; width of body 3.35 to 3.5 in its depth, which is 1.75 to 2 in its length and one and three fourths times to twice the length of the head; abdominal region moderate, 1.25 to 1.35 in the length of the anal; caudal peduncle from three tenths to five ninths longer than deep, its least depth from a little less to a little more than the eye-diameter. Head small, its length 3.3 to 4 in that of the body, its width 1.95 to 1.8 in its depth, which is slightly more than its length; cranio-nuchal keel moderate to weak. Snout short and blunt, deeper than long, its anterior profile sloping somewhat backwards in the young, vertical in the adult, its length 1.25 to 1.1 in the eye-diameter, which is 3 to 3.5 in the length of the head; adipose lid little developed; interorbital region elevated and strongly convex, its width from one fifth to one half more than the eye-diameter and 2.2 to 2.67 in the length of the head. Upper jaw slightly projecting; maxillary extending to below the anterior border of the pupil, its length 2.9 to 3.35 in that of the head, the width of its rounded distal extremity subequal to its distance from the eye and 3.33 to 4.67 in the eye-diameter. Preopercular angle broadly rounded and somewhat produced, the membranous border entire, the hinder limb inclining slightly forwards.

Jaws, vomer, and palatines with bands of minute teeth in the young, which gradually disappear with advancing age, the adults toothless.

Scales small, thin, and deeply embedded, ovate, increasing slightly in size posteriorly; entire head and nuchal ridge naked. Lateral line curved upwards above the base of the pectoral, thence descending in a long, shallow, often irregularly undulated curve to below the middle of the soft dorsal, thence straight, the pores about 130.

Dorsal fin with vi, i 18 to 20 rays; spines short and stout, united by membrane in the young, separate in the adult, evenly graduated from the front, the last 1.75 to 1.25 in the eye-diameter; procumbent spine strong and exposed; soft dorsal originating from one third to one sixth nearer to the root of the caudal than to the tip of the snout, the anterior rays produced, the first the longest, 2 to 3 in the body-length, and extending when depressed to between the anterior fifth of the caudal and the base of the 14th dorsal ray; last ray not produced. Caudal fin long and deeply forked, the lobes acute and of equal length, 2.75 to 2.5 in the length of the body. Anal fin with ii, i 16 or 17 rays,

originating below the 7th dorsal ray; 2nd spine longest, 1.85 to 1.55 in the eye-diameter; anal lobe lower than that of the soft dorsal, 2.7 to 3.8 in the body-length, and extending when depressed to between the middle of the peduncle and the base of the 13th ray. Pectoral pointed, with 19 rays, its length 4.25 to 4.67 in that of the body; 5th ray longest, reaching in the young to above the 1st anal spine, in the adult to above the vent. Ventral moderate, inserted well behind the pectoral, its length 1.4 to 2.15 in that of the pectoral and 6 to 10 in the body-length; outer ray longest, extending somewhat beyond or to the vent.

Gill-rakers short, 6 + 9 on the anterior arch, the longest 9.5 to 16 in the length of the head. Vent about one sixth nearer to the anal than to the origin of the ventral. Pyloric appendages 12 to 14.

Glaucous above, the sides silvery; cheeks, throat, abdomen, and lower surface silvery in the young, golden in the adult. Dorsal and upper caudal lobes greenish brown; shorter rays of dorsal and anal pale reddish brown with a lighter border; lower caudal and anal lobes and ventrals golden; pectoral glaucous; iris silvery. (*ovatus*, egg-shaped.)

Described from 4 specimens, measuring respectively 140, 181, 247, and 375 millim.; two of these belong to the Queensland Museum and two to the Amateur Fishermen's Association, by whom they were kindly lent to me. The smallest was obtained from Raine Island and was donated by the Wanetta Pearl Company; the second was collected at Darnley Island by Dr. J. R. Tosh; the two others are from Moreton Bay.

Historical.—The Snub-nosed Swallowtail was known to the older Dutch voyagers who sought fortune in the Indies, and opened up the riches of the Spice Islands to the trade of Europe; whose discoveries were in fact the precursors of our own countrymen's still greater achievements in those bygone days, when human ingenuity, badly equipped but indomitable, pitted its weakness against the forces of nature and the unknown in its ceaseless struggle to elucidate the secrets of the mysterious Orient. Under the name of "pesque-pampus" Renard gave us the earliest figure of this species in his work on the Fishes and Crustaceans "*que l'on trouve autour les Isles Moluques et sur les côtes des Terres Australes.*" This figure was reproduced by Valentyn in his account of Amboina. In 1858 Linnæus briefly described it from Asiatic examples as *Gasterosteus*²⁸ *ovatus*, and in this erroneous position it remained through all the subsequent editions of the *Systema Naturæ* up to Dr. Turton's English translation in 1806. Thirty years before this Forskal had, however, more correctly assigned this fish to the Linnæan genus *Scomber*—with which in his time the bulk of the present-day carangids were associated—under the appropriate name of *S. falcatus*, his

²⁸ The Linnean genus *Gasterosteus* originally contained eight species, and included besides the present fish such diverse forms as the Pilot-fish (*Naucratus ductor*) carangid, a featherfins (*Pterois volitans*) scorpenid, and a flying gurnard (*Cephalacanthus spinarella*),^a as well as the sticklebacks, to which the name is now restricted.

^a This appears to me to be the correct name of the Atlantic species, which Regan (Ann. & Mag. Nat. Hist. (8) xi, 1913, p. 183) calls *Dactylopterus volitans*. *Cephalacanthus* Lacépède has page precedence over the same author's *Dactylopterus*, while *Gasterosteus spinarella* Linnæus (p. 297) is five pages earlier than *Trigla volitans* (p. 302). The mistake seems to have arisen through confusing Linnæus' *Gasterosteus volitans* (p. 296), which is our *Pterois volitans*, with his *Trigla volitans*, which is the present species. Jordan & Richardson (Proc. U. S. Nat. Mus., xxxiii, p. 665) have fallen into the same trap.

specimens having been taken at Jeddah and Lohaia on the Arabian shore of the Red Sea. In no event, however, could this name have stood, for Linnæus' *Labrus falcatus*, from the East Coast of the Americas, is also a *Trachinotus*, and so closely allied to the present species that Günther united them under the earlier name *ovatus*. Lacépède, in the third volume of his *Histoire Naturelle*, described the species by no less than three distinct generic and specific names. He first proposed the genus *Trachinotus*, which is now universally recognised, basing it on Forskal's *Scomber falcatus*, and within a few pages redescribed it as *Casiomorus blochii*, from a drawing by Commerçon of a fish taken at Fort Dauphin, Madagascar. Finally he assigned it to his genus *Centronotus*, of which Linnæus' *Gasterosteus ductor* is the type, as *C. ovalis*. In the following year Russell described and figured it from the Coromandel Coast of India under the name "Mookalee Parah." Rüppell, some twenty-five years later, recorded it under Lacépède's first name from Massawa and observes that it is common in winter. Valenciennes records it under six different names. In his first essay he describes it as *Trachinotus mookalee* from specimens sent to Paris by Messrs. Leschenault from Pondicherry—where, he stated, it was rarely taken but occurred at all seasons of the year—and Dussumier from Malabar, recognising in it Russell's species mentioned above; the reason for the change of name is not, however, apparent, since he correctly identifies that fish with the *Gasterosteus ovatus* of Linnæus. He next notices it as *T. blochii*, stating that his diagnosis is taken from "a more accurate description which we have found in the newly discovered papers of Commerçon." As *T. affinis* and *T. falciger* he redescribed it from specimens collected by Dussumier on the Malabar Coast, and again as *T. drepanis* from a small example obtained by the same collector at the Seychelles, where it was reported as abundant. Finally he recorded it from the Red Sea as *T. falcatus*, his description following those of Forskal and Rüppell. In 1845 Richardson gave it yet another name, *T. auratus*, from examples captured at Canton, noting, however, its close affinity to *T. mookalee*, under which name Cantor records it from the Sea of Pinang, where it appears to be scarce, as he only met with two young examples during his three and a half years' residence there. Up to the date of the issue of the second volume of Günther's Catalogue Bleeker also identified the Malayan fish as *T. mookalee*, under which name he records it from numerous localities, as too he subsequently did under *T. ovatus*. To Dr. Günther belongs the credit of first definitely associating our fish with the Linnæan *G. ovatus*, but he made the mistake of uniting the Atlantic and Indo-Pacific species, which are better kept separate, the former as *T. falcatus*, the latter as *T. ovatus*, though it must be allowed that the differences are but slight.²⁹ Günther mentions a specimen in the British Museum as being from Australia, and this is, so far as I can ascertain, the earliest notice of the species from the seas of the Commonwealth; in the same list he records an example taken by Macgillivray at Aneiteum, New Hebrides. No further information regarding its distribution came to hand until sixteen years later, when Günther, in the *Fische der Südsee*, announced its presence in the Samoan Group on the authority of the Rev. S. J. Whitmee, but added that it was rare

²⁹ Comparing the latest available detailed description of the Atlantic fish (Jordan & Evermann, *Fish. North & Mid. America*, p. 941) with the above I find the following differences:—
 Maxillary extending to below middle of eye, 2·67 in head; anal lobe shorter, about 4·3 in body-length; ventral short, 3 in head *falcatus*.
 Maxillary extending to below anterior border of pupil, 3 in head; anal lobe longer, 3·8 or more in body-length; ventral longer, 2·5 or more in head *ovatus*.

among the South Sea Islands, a remark which subsequent investigations have shown to be correct. The first definite locality attached to an Australian specimen is that established by Alleyne and Macleay in 1877 who, in their account of the Fishes of the Chevert Expedition, recorded its capture at the Percy Islands, M.Q., thus adding this fine fish to our Queensland fauna. Their record was quickly verified by Klunzinger who, two years later, listed it from Cleveland Bay, N.Q., and Günther who, in the following year, recorded it from Somerset, N.Q., from specimens brought back by the Challenger Expedition. Macleay in 1881 gave its Australian distribution as "Port Jackson. All Australian Coasts." I do not know on what grounds he made this sweeping statement, but it is certainly quite unwarranted. As far as Port Jackson is concerned his record is copied from Castelnau,³⁰ whose description refers to *T. boila*, and has unfortunately been passed on by other writers on the New South Wales fishes (Woods, Ogilby, Waite). Personally I do not know of any example which can be unquestionably assigned to the southern State, nor does McCulloch, with whom I communicated on the subject. Stead, however, writes me thus—"I have certainly seen *Trachinotus ovatus* from New South Wales waters, though rarely, and always among consignments of fish coming in from our northern waters." It is certainly not found in Victoria nor Tasmania, and it has not been recorded from either South or West Australia nor from the Northern Territory,³¹ though it is doubtless found in the two last-named areas. Macleay subsequently recorded a specimen from Port Moresby, B.N.G.; Jordan and Richardson obtained it from Formosa, this being the most northerly position from which it has as yet been recorded. Jordan and Seale were unable to add any further South Sea localities to those already known, though they collected three specimens at Samoa, but Kendall and Goldsborough report the capture of a small specimen at Vavau in the Tonga Group.

Uses.—This species is so scarce, at least with us in Southern Queensland, that I am unable to give personal information as to its value as a food-fish. Most of the older writers, however, give it an excellent character. Valentyn's verdict, for instance, is "small but very delicate," a remark which suggests that he did not know the adult fish. Rüppell writes of it as being "very good eating." Both Leschenault and Dussumier reported to Valenciennes that "its flesh is fine and choice." The only discordant note in this chorus of praise was sounded by Russell who tells us, writing of a 20-in. example, that "it is a dry insipid fish," a statement which is retailed without comment by Day who, however, allows that it "smokes well." Taking into consideration its very close relationship to the "pampano" of the Atlantic, and the very high character for excellence to which that species has attained, I incline to the belief that the snub-nosed swallowtail will prove an acquisition to our tables, when modern methods of capture and distribution have placed it within our reach.

Range.—From the Red Sea southward to Madagascar and the Seychelles, and eastward through the Indian and Malayan Seas to Intertropical Australia, New Guinea, the New Hebridean, Tongan, and Samoan Archipelagos. In

³⁰ Proc. Linn. Soc. N. S. Wales, iii, p. 383.

³¹ Is it not time that this huge tract of land received a distinctive appellation and its baptism as a State? And what more fitting tribute than this could be paid to the memory of one of the greatest of the Empire's sons—Charles Darwin—who visited it in the "Beagle" as long ago as 1836. Floreat Darwinia!

Australian waters it is so far known from the coasts of Queensland and Northern New South Wales (*Stead*) only. In this State it has been recorded from Moreton Bay, S.Q. (*O.C. & Ogilby*),³² Percy Islands, M.Q. (*Alleyne & Macleay*), Cleveland Bay, N.Q. (*Klunzinger*), Somerset, N.Q. (*Günther*), Raine Island, B.R. (*Ogilby*), and Darnley Island (*Tosh*). From British New Guinea it has been sent from Port Moresby (*Macleay*). Passing eastward we find it occurring at Aneiteum and Samoa (*Günther*) and Vavau (*Kendall & Goldsborough*). Turning to the westward, Bleeker received it from the Austro-Malayan Islands of Amboina, Obi, and Celebes, and from the Indo-Malayan Borneo, Biliton, Java, Banca, Sumatra, Pinang, and Cocos. It has been recorded from Formosa (*Jordan & Richardson*), Macao (*Richardson*), China (*Bleeker*), and the Andamans (*Day*), is common on both sides of the Indian Peninsula, whence it ranges westward to South Arabia (*Steindachner*) and the Red Sea, and south-westward to the Seychelles (*Dussumier*) and Madagascar (*Commerçon*).

Dimensions:—My largest example measured, as stated above, 375 millim., but Russell records one of 510, and Rüppell states that it grows to 760. Commerçon's specimen, which formed the type of *Cæsiomorus blochii* Lacépède, was a little over 450 millim. and weighed 3 lb., but he remarked that it attained twice that size.

Illustration:—Our figure is taken from the Raine Island fish, and is on exhibition in the show-cases of the Queensland Museum, Reg. No. I. 14/1912.

PART VII.—LETHRINIDÆ (No. 1).

FAMILY LETHRINIDÆ.

Lethrinidæ Regan, Ann. & Mag. Nat. Hist. (8) xii, July 1913, p. 123.

THE WHIPTAIL, OX-EYE, AND EMPEROR BREAMS.

Body compressed, covered with moderate or rather small, adherent, ciliated scales. Lateral line complete, not extending on the caudal fin, the tubes bifid or simple, not reaching the border of the scale. Head partially scaly, with moderate or long, pointed snout. Mouth terminal, protractile, with moderate, oblique cleft. Jaws anteriorly with rows of villiform teeth, preceded by canines; laterally with a single series of stout teeth, which may be conical or obtuse; roof of mouth and tongue toothless. One dorsal fin, with 10 heteracanthous spines, the spinous portion much longer than the soft and depressible in a groove. Caudal fin more or less deeply emarginate, with 17 principal rays, 15 of which are branched. Anal fin short. Pectorals pointed. Ventrals thoracic, approximate, pointed, with 15 rays, inserted behind or below the pectoral-base; accessory scale present. Gill-openings wide; gill-membranes united, free from the isthmus; six branchiostegals; pseudobranchiæ present; gills four, a slit behind the fourth; gill-rakers mostly reduced to a few spinulose prominences; pharyngeal bones separate. Air-bladder present. Stomach cæcal; pyloric appendages in small number; intestinal canal short. Vertebrae 24 (10+14).

³² This specimen was purchased in the Brisbane market by Mr. Vincent Jeff, a fishmonger of long standing and wide experience, who kindly presented it to me. That he had never before seen anything like it proves its great rarity in our southern waters.

Regan supplies the following skeletal characters—"Premaxillaries with rather long pedicels and short rami; the latter without posterior expansions or processes, and with their distal ends internal to the maxillaries. Occipital crest strong; parietal crests moderate or strong. All the precaudals with parapophyses, all the ribs, or all but the first, inserted on the parapophyses."

Regan further subdivides the family in two groups, based upon the following cranial characters—

"Subocular shelf small, emitted by the second suborbital but mainly internal to the first; maxillary with a very broad posterior expansion below its articulation with the palatine; maxillary process of palatine normal; outer face of palatine with a prominent ridge which extends on to the pterygoid" PENTAPUS, SPHERODON.

"Subocular shelf vestigial, a minute process of the second suborbital at its junction with the first; maxillary with a moderately broad posterior expansion, which is overlapped by a flattish downwardly curved branch of the maxillary process of the palatine; outer face of palatine without ridge" LETHRINUS.

A small and compact family of percoidean fishes of moderate size, closely allied to the *Lutjanida*, containing some of our finest food-fishes, and inhabiting chiefly the inshore waters of the Indian and Western Pacific Oceans; one species ranging eastward to the Hawaiian Islands, another from the West Coast of Africa. Three genera¹ with numerous species recognised.

Synopsis of lethrinoid Genera.

*a*¹. Cheeks scaly; maxillary exposed distally.

*b*¹. Upper surface of head scaly; eye moderate; opercle with a pungent spine; lateral jaw-teeth conical i. PENTAPUS.

*b*². Upper surface of head naked; eye very large; opercle without pungent spine; lateral teeth molariform ii. MONOTAXIS.²

*a*². Cheeks and upper surface of head naked; maxillary concealed; eye moderate; opercle without true spines iii. LETHRINUS.

Note:—The genus *Monotaxis* has not as yet been recorded from Queensland waters, but it has a wide range from the Red Sea on the west to Hawaii on the east, and is a common fish among both the Malayan and the South Sea Islands; it has also been recorded from "New Holland" by Kner and from the Engineer Group off the south-east of Papua by Macleay. It is, therefore, only a matter of time until its occurrence on our shores be made known. The enormous eye, which is persistent through life, should attract collectors, while the young or half-grown fish, with its two broad white cross-bands on an olive green or roseate ground, forms so striking an object that its presence in our northern waters should be easily ascertainable.

PENTAPUS Cuvier and Valenciennes.

Pentapus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 258 (*vittatus*); Günther, Brit. Mus. Catal. Fish., i, 1859, p. 380; Day, Fish. India, pt. i, 1875, p. 93; Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 100.

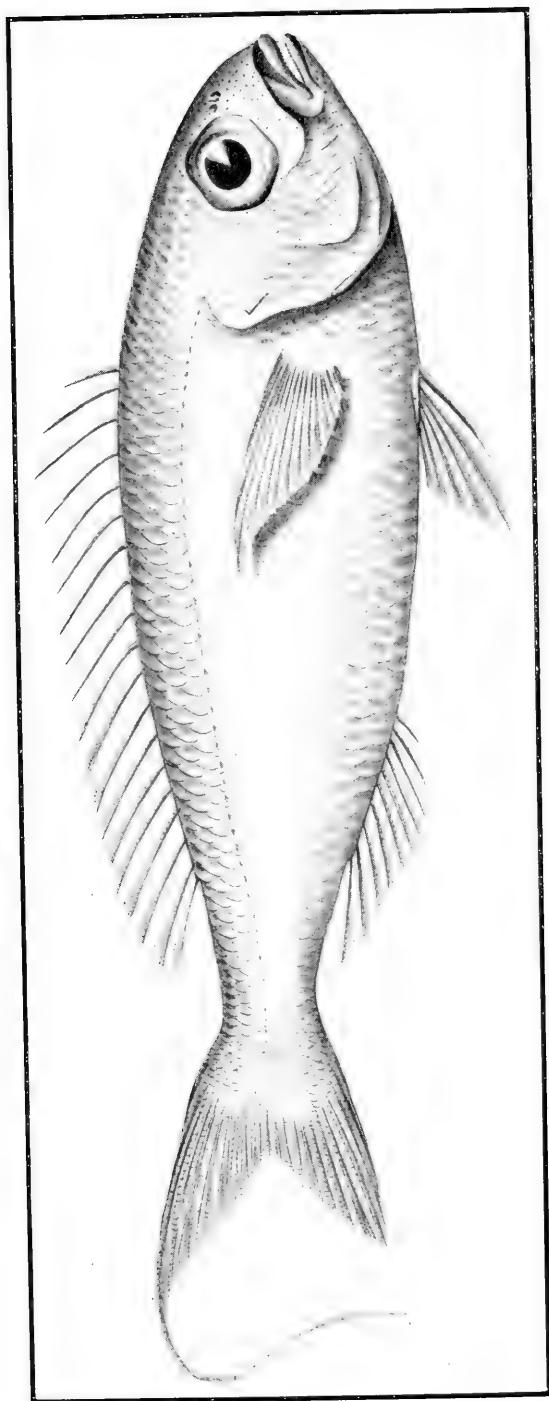
Leiopsis Bennett, in Life of Raffles, 1830, p. 688.

Gnathodentex Bleeker, Versl. Akad. Amsterdam (2) vii, 1873, p. 41 (*aurolineatus*).

¹ I can not admit the validity of Fowler's genus *Lethrinella*, because I have no specimens of *L. miniatus* on which to form a judgment, and because I have not had an opportunity of consulting the paper in which it is described, and which is not, so far as I know, to be found in Australian libraries. With regard to *Neolethrinus* Castelnau (Res. Fish. Austr., 1875, p. 11), if the author's description be correct, it can not belong to this family.

² *Monotaxis* Bennett, Life of Raffles, 1830, p. 683 (*indica*=*grandoculis*).

Sphaerodon Rüppell, Neue Wirbelth. Abyss., Fisch., 1837, p. 112 (*grandoculis*).



PENTAPUS AURIFILUM Ogilby. ♂ Nat. Size.

Phyllis Clarke, del.

Body elliptical, compressed. Scales moderate, adherent, etenoid. Lateral line tubes bifid, extending over the entire exposed surface of the scale. Head moderate, with rather long pointed snout and narrow deeply cleft preorbital; scaly, except on the snout, preorbital, and suborbital; preopercle more or less naked; cheek-scales in more than three series. Cleft of mouth moderate and a little oblique, the jaws equal; maxillary exposed posteriorly. Jaws with bands of villiform teeth and two or three pair of small anterior canines. Eye moderate. Opercle with a small spine. Dorsal fin with x 8 to 10 rays, the spinous portion much longer than the soft, naked, and depressible in a groove. Caudal deeply emarginate, one or both lobes sometimes produced in a filament. Anal similar to the dorsal, with iii 7 to 10 rays, the 3rd spine longest. Pectoral short and pointed, with 14 to 16 rays. Ventral inserted behind the pectoral-base; accessory scale present.

Fishes of rather small size, inhabiting the warmer parts of the Indian and Western Pacific Oceans.

PENTAPUS AURIFILUM Ogilby.

Pentapus aurifilum Ogilby, New Fish. Queensl. Coast, 20 Dec. 1910, p. 93.

YELLOWLIP.

(Plate XX.)

Type locality.—North Reef.

Body elliptical, the ventral profile more arched than the dorsal, its width 1.84 in its depth, which is 3 to 3.45 in its length and subequal to the length of the head. Caudal peduncle twice as long as deep, its least depth 10 to 11.25 in the length of the body. Head about one third longer than deep, its upper profile level from above the anterior border of the eye, its width 1.66 in its length, which is 3.33 to 3.6 in that of the body. Snout rather short, with evenly convex profile, its length 3.15 to 3.33 in the length of the head. Eye rather large, its diameter a little more than the length of the snout and 2.6 to 3 in the length of the head. Interorbital region feebly convex, its width 1.3 to 1.4 in the eye-diameter. Jaws equal; maxillary extending to below or slightly beyond the anterior border of the eye, its length 2.9, that of the mandible 2.33 in the length of the head. Preopercle entire or feebly crenulate, naked; opercle with a small sharp spine.

Upper jaw with three pair of small canines, the outer the largest; mandibular canines vestigial.

Scales in 49 to 51 transverse series, in 3/1/10 in the series running obliquely backwards from the origin of the dorsal fin.

Cheek-scales in 3 series; preopercle naked; occipital scales extending forwards to form a convex border between the posterior margins of the pupils.

Dorsal fin with x 9 rays, the soft portion about two thirds of the length of the spinous; 5th spine longest, a little shorter than the anterior rays and 2.15 to 2.33 in the length of the head. Middle caudal rays about 2.25 in the upper lobe, without the filament, which is 4.5 in the body-length; 2nd ray of upper lobe produced in a long slender filament. Anal fin originating below the 2nd dorsal ray, with iii 7 rays, the spines evenly graded, the last one third of the length of the head and a little shorter than the 1st ray; last ray somewhat produced, longer than the 1st. Pectoral fin with 16 rays, its length 3.75 to 4 in that of the

body, 5th ray longest, not or just reaching the vertical from the vent. Ventral fin 1.5 in the length of the pectoral and 1.4 in that of the head, the outer ray the longest, extending not quite to, to, or a little beyond the vent.

Gill-rakers 4 or 5 + 8 or 9, short and claviform, the shortest 6 to 6.67 in the eye-diameter.

Upper surface red, gradually shading through the rose-pink of the sides to the pearly white of the belly; a yellow lateral band from the opercle to the upper caudal lobe, and a pair of similar bands, united anteriorly, from the isthmus to the lower caudal lobe, passing just outside the bases of the ventral and anal fins. Upper lip saffron-yellow. Dorsal, anal, pectoral, and ventral fins hyaline, the first tipped with gold; caudal pink, with a wide greenish yellow terminal border and the filamentous ray brilliant sulphur yellow. (*aurum*, gold; *filum*, a thread or filament.)

Described from 5 examples, measuring from 195 to 298 millim., taken on the Queensland Coast between Cape Moreton and Edgecumbe Bay, at depths varying from 13 to 70 fathoms.

Nothing is known of this beautiful species save such statistics of distribution as were collected on board the "Endeavour." The total number of specimens trawled was 840, to which must be added a single example taken by hook off Cook Island, Byron Bay, the most southern point where it was found. Appended is a summary of the Queensland localities at which it was obtained with particulars of soundings, etc.

"Cape Moreton, N. 53° W., 5 miles; 51 fath., dark sand and shell, 2 examples. Cartwright Point, S. 18° W., 11 miles; 24 fath., fine sand, 20. Low Bluff, S. 10° E., 6 miles; 15 fath., fine sand, 18. Double Island Point, N. 30 W., 19 miles; 33 fath., fine dark sand, 52. Double Island Point, N. 42° W., 3.5 miles; 33 fath., fine dark sand, 1. North Reef, N.E. ½° E., 13 miles; 70 fath., fine sand and shell, 66. Cape Capricorn, S.E., 14 miles; 13 fath., ?, 1. Hummocky Island, S. 7° E., 7 miles; 15 fath., sand and shell, 2. Pine Peak, S. 58° E., 14 miles; 25 fath., mud, 367. Cape Gloucester, S. 62° W., 21 miles; 36 fath., sand and mud, 305. Cape Gloucester, S. 13° E., 5.5 miles; 25 fath., mud, 5. Bowen Light, S. 22° W., 7 miles; 14 fath., sand and mud, 1."

If trawling should become general on the Queensland Coast this species is likely to become a favorite breakfast fish, supplemental to the whittings and other fishes of similar size.

LETHRINUS Cuvier.

Lethrinus Cuvier, Règne Anim., ed. 2, 182 (*chærorhynchus*); Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 272; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 453; Day, Fish. India, pt. 1, 1875, p. 134; Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 110; Jordan & Thompson, Proc. U. S. Nat. Mus., xli, 1912, p. 558.

Lethrinella Fowler.

Lethrinichthys (subgenus of *Lethrinus*) Jordan & Thompson, *ibid.* (*nematacanthus*).

Body ovate to subovate, compressed. Scales moderate, adherent, finely ciliated. Lateral line tubes simple and straight, extending over the basal half of the scale only. Head large, with long pointed snout and wide preorbital, naked except the opercle, subopercle, and a part of the postorbital and parietal regions. Cleft of mouth moderate and oblique, the jaws equal; maxillary concealed. Jaws anteriorly with two or three pairs of caninoid teeth, behind which are several series of small sharp cardiform teeth; lateral teeth strong, in a single series. Eye

moderate. Opercle with two blunt points, the upper little prominent. Dorsal with \times 9 rays, the spinous portion much longer than the soft, depressible in a scaly sheath. Caudal emarginate. Anal with iii 8 rays, the spines strong. Pectoral long and pointed, with 13 rays, the 2 upper simple. Ventral inserted below or a little behind the pectoral-base; accessory scale present.

Fishes of moderate size, inhabiting the warmer zones of the Indian and Western Pacific Oceans; one species from the West Coast of Africa. A large number of species—about 90—have been described by various authors, but only about one third of these are sufficiently characterized. Of the irre recognizable remainder Valenciennes is responsible for fully half, but of these Sauvage claims to have rediscovered nine, namely—*L. frenatus*, *L. semicinctus*, *L. olivaceus*, *L. borbonicus*—and Steindachner one—*L. genivittatus*—but the works in which these authors redescribe the species are not available to me.³ Two of the remaining species—*L. cyanoxanthus* and *L. cinnabarinus*—are figured by Richardson in the *Icones Piscium*, 1843, pl. iv, figs 1 & 2, as coming from Australia, but they have not since been recognized.

Owing to the many characters which, in most fishes differential, are common to all the members of this genus, the difficulty of distinguishing between the species is greatly increased. On this subject Bleeker pertinently remarks⁴:—

“The species of the genus are numerous but rather difficult to define satisfactorily. They resemble one another in the formula of the spines and rays, in the number of the scales on the lateral line varying only between 45 and 50, in the lepidosis of the head, etc. We have attempted to find specific characters in the length of the snout, in the relative height of the preorbital, and in the form of the posterior jaw-teeth; but these characters have only a proportional value, since the snout becomes longer with the age of the individual, the height of the preorbital increases from the young to the adult state, and the lateral teeth of the jaws, obtuse or rounded and molariform in old examples, are frequently conical and pointed in the young of the same species. Nor do we find more distinctive characters in the coloration. The large blackish lateral spot, thought to be characteristic of certain species, is often present in immature individuals only and usually disappears with advancing age. The body-colors, vivid in the young and often variegated with bands, bars, ocelli, and spots, become more or less uniform in the adult, and commonly disappear in such as are preserved for a length of time in liquor. The most distinctive characters may be found in the number of longitudinal series of scales above the lateral line, in the shape of the profile, in the relative heights of the body and head [as compared with their respective lengths], in the strength and relative length of the dorsal spines, and in the height of the anal [as compared with its length].”

LETHRINUS NEBULOSUS (Forsk.)

Sciæna nebulosa Forskal, Deser. Anim., 1775, p. 52; Bonnaterre, Encycl. Méth., Ichth., 1788, p. 124 (after Forskal).

³ Sauvage, in Grandidier's History of Madagascar, vol. xvi, 1891, and Steindachner, Verh. Zool-bot. Ges. Wien., 1866, p. 478.

⁴ Atlas Ichth., viii, p. 110.

Lethrinus nebulosus Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 284; Rüppell, Neue Wirbelth. Abyss., Fisch., 1837, p. 118; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 460; Playfair, Proc. Zool. Soc. London, 1867, p. 854; Klunzinger, Verh. Zool.-bot. Ges. Wien, 1870, p. 86; Day, Fish. India, pt. i, 1875, p. 136, pl. xxxiii, fig. 4; Bleeker, in Pollen & van Dam, Faun. Madagascar, pt. 4, 1875, Poiss. p. 91; id., Verh. Akad. Amsterdam, xviii, 1879, p. 12; Klunzinger, Sitz. Akad. Wien, lxxx, i, 1879, p. 352; Günther, Zool. Challenger, i, 1880, Shore Fish., pp. 34, 39; Macleay, Proc. Linn. Soc. N. S. Wales, ix, 1884, p. 16 (after Günther); Kent, Great Barrier Reef, 1893, p. 369; Steindachner, Abh. Senck. Nat. Ges., xxv, 1901, p. 418; id., Denk. Akad. Wien, xxxix, 1902, p. 11; Jordan & Seale, Bull. U. S. Bur. Fisher., xxv, 1906, p. 270.

Lethrinus Gothofredi Cuvier & Valenciennes, *ibid.*, p. 286.

SPANGLED EMPEROR.^{4a}

Type locality.—Red Sea at Jeddah (*L. nebulosus*).

Red Sea at Suez (*L. gothofredi*).

Trincomalee, Ceylon (*L. opercularis*).

Body subovate to ovate, the dorsal contour well elevated, its width 2.2 to 2.55 in its depth, which is 2.35 to 2.8 in its length and a little more than the length of the head. Caudal peduncle much longer than deep, its least depth 8.5 to 9.25 in the body-length. Head a little longer than deep, its upper profile slightly concave to above the nostrils, beyond which it is similarly convex, its width 2.15 to 2.3 in its length, which is 2.85 to 3.05 in that of the body. Snout long and pointed, its length 1.75 to 1.9 in that of the head. Diameter of eye 2.1 to 2.5 in the length of the snout and 1.3 to 1.55 in its distance from the angle of the mouth. Interorbital region strongly convex, its width 4.1 to 4.33 in the length of the head, and varying from rather more than the eye-diameter in the adult to as much as or even less than the same in the half-grown and young. Jaws equal; maxillary extending to below the anterior nostril, its length 3 to 3.15, that of the mandible 2.33 to 2.5 in the length of the head. Hinder limb of preopercle linear and vertical; opercle with two blunt points, the upper little prominent.

Canine teeth moderate; posterior lateral teeth molariform.

Scales in 47 or 48 series above the lateral line, in 6/1/16 or 17 from the base of the first dorsal spine obliquely backwards; postocular scales in two irregular series, smaller and more numerous than the parietal series, which is mostly single.

Dorsal fin originating above the pectoral-base, the spines slender but not flexible, the 4th or 5th longest, 2.45 to 2.55 in the length of the head and 1.1 to 1.2 in the middle rays; remaining spines evenly and gently graded, the last three subequal; soft dorsal one eighth to one third longer than high. Caudal deeply emarginate, with pointed lobes, the middle rays 1.45 to 1.9 in the upper lobe, which is 3.6 to 3.75 in the body-length. Anal originating below the 1st dorsal ray, the 3rd spine as strong as and longer than the 2nd, its length 2.75 to 3.3 in that of the head; soft anal a little longer than high, the rays subequal, one seventh to one fourth longer than the 3rd spine. Pectoral with 13 rays, its length 3.15 to 3.4 in that of the body; 2nd ray as long as or slightly longer than the 3rd, and extending to above the anal spines or not quite so far. Ventral inserted a little behind the pectoral-base, the spine weak and flexible, 1.45 to 1.7 in the outer ray, which is the longest, extending beyond the vent in the young, to or not quite to the vent in larger examples.

^{4a} Through misadventure we are unable to publish a plate of this species.

Gill-rakers 6+5, short and stout.

Upper surface of body pale olive brown, shading into silver gray on the breast and abdomen; each scale of the back and sides with a light blue central spot, and usually a much smaller dark basal spot, the upper and lower edges narrowly dull gold, forming more or less continuous slender bars parallel to the dorsal profile. Head dull violet or purplish above, with or without a broad lighter cross-band between the eyes; cheeks gray, with a violet iridescence and numerous small blue spots, which are not apparent until after death; preorbital crossed by three light blue bands radiating from the eye, the first to the anterior nostril, the second to the middle of the preorbital-edge, the third to the angle of the mouth; the first is constant, but the last two may be much curtailed in front or even reduced to a mere spot; a blue blotch sometimes present at the postero-superior angle of the eye; opercles blue-spotted; inside of mouth orange, of opercles scarlet, the colours greatly reduced or absent in the young. Fins colorless, except the first and the basal third of the second pectoral rays, which are blue.

In the freshly caught young fish there are three or five scale-wide dull gold horizontal bands below the lateral line, the middle the longest and most persistent, reaching to the peduncle; an obscure dark blotch between the lateral line and the appressed pectoral, and several narrow oblique cross-bands due to the darkening of the edges of certain series of scales. Dorsal fin with two rows of dull gold spots anteriorly and three similar oblique bands posteriorly; caudal with traces of four dark cross-bands, which are most conspicuous at the outer edges. (*nebulosus*, clouded; the application is obscure.)

Described from 3 Moreton Bay examples in the collection of the Queensland Museum, measuring respectively 314, 223, and 215 millim., two of which were kindly presented by the officers of the Metropolitan Fish Market.

Historical.:—The first notice of this fish was published by Forskal, who assigned it to the Linnæan genus *Sciæna* and, according to Valenciennes, gives its Arabic name as “schaur.”⁵ From his time it does not appear to have been again noticed until Ehrenberg rediscovered it at Massawa, on the Abyssinian shore of the Red Sea, where it was known by the same vernacular name as Forskal reported from Jeddah. Günther (1) extended its range to the Seychelles (fide Valenciennes) and the Coast of Mozambique (fide Peters), but both these references rightly belong to *Lethrinus centurio* Cuvier & Valenciennes,⁶ the identity of which with our species, though possible, is by no means clear, while the figure of *L. esculentus*⁷ of the same authors, apparently an alternative name of *L. centurio*, bears not the remotest resemblance to our fish. Subsequently, however, Günther (2) was able to record the species from Somerset, N.Q., this being the earliest Queensland record, and even so far eastward as Levuka, an island of the Fiji Group, which is, according to Jordan and Seale, the only South Seas locality as yet noticed. Meanwhile Playfair had obtained the true *Lethrinus nebulosus* from the Seychelles; Day also had noted it from the Indian

⁵ Bonnaterre, ostensibly following Forskal, states that the name among the Arabians is “abu-hamrur,” but surely this should properly apply to the species which Forskal called *Sciæna hamrur*, the *Priacanthus hamrur* of modern writers.

⁶ Ibid., p. 301; Day, *ibid*.

⁷ *Idd.*, pl. elviii.

Seas, remarking that it was "very common at Madras," while Klunzinger had added it to the Commonwealth fauna on the strength of a specimen received from Port Darwin, N.T. Bleeker added Madagascar and Mauritius to its already extensive range, and finally Steindachner received specimens from South Arabia and Halmahera (Gilolo).

Uses.—Like all its congeners it is an excellent food-fish, and so realizes a high price in the Brisbane shops, where, however, large specimens are seldom seen, since these are most frequently caught on the outside Snapper Grounds by members of pleasure parties, each and all of whom are adamant in the matter of parting with what they justly consider one of their most valuable prizes.

Food.—According to Ehrenberg it feeds principally on hard shell-fishes (*Cardium* and the like), but with us it takes a bait, whether mullet or squid, freely and is a game fighting fish when hooked.

Range.—From the Red Sea and the East Coast of Africa through Madagascar, Mauritius, and the Seychelles to the shores of India, Gilolo, North and East Coasts of Australia south to the Moreton Bay District, where it is scarce. Fiji fide Günther.

A remarkable fact in connection with the distribution of this large and showy fish is the failure of such voluminous writers on the Malayan fish-fauna as Bleeker, Cantor, and more recently Weber, and of the energetic band of American scientists, who have been for some years exploiting the Philippines, to obtain specimens from either the Indo-Malayan or, Gilolo excepted, the Austro-Malayan subregions. So strange is this that one would almost feel inclined to doubt the specific identity of the Western Pacific fish with that of the Indian Ocean. Day's description, however, agrees very fairly with our fish, except as to the color-markings of the fins and the length of the tail, which is much shorter in the Indian fish.

In connection with this, one fact, however, forcibly strikes the inquirer, namely, that the closely allied, if distinct, *L. opercularis*⁸ is found commonly throughout these subregions, and is in fact, according to Bleeker, "the most common species of the genus in the Archipelago."⁹

⁸ Cuvier & Valenciennes, Hist. Nat. Poiss., vi, 1830, p. 289 : Trineomalee.

⁹ If I am correct in associating this species with *L. nebulosus*, the following should be added to the synonymy as known to us :—

Lethrinus opercularis Cuvier & Valenciennes, *ibid.*, p. 289 ; Bleeker, Nat. & Geneesk. Arch. Ned. Ind., ii, 1845, p. 522 ; *id.*, Verh. Batav. Gen., xxiii, 1850, Sparoid., p. 14 & Midd-en Oost-Java, p. 8 ; *id.*, Nat. Tijds. Nederl. Ind., ii, 1851, p. 471 ; *id.*, *ibid.*, iii, 1852, pp. 160, 444 ; *id.*, Verh. Batav. Gen., xxv, 1853, Bengal, p. 38 ; *id.*, Nat. Tijds. Nederl. Ind., viii, 1855, p. 344 ; *id.*, *ibid.*, xii, 1856, p. 214 ; *id.*, *ibid.*, xiii, 1857, pp. 371, 479 ; *id.*, *ibid.*, xv, 1858, p. 222 ; *id.*, *ibid.*, xvi, 1859, pp. 239, 406 ; *id.*, *ibid.*, xvii, 1859, p. 234 ; *id.*, *ibid.*, xviii, 1859, p. 352 ; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 461 ; Bleeker, Act. Soc. Sci. Indo-Neerl., viii, 1860, Sunatra, p. 20, Celebes, p. 27 ; *id.*, Versl. Akad. Amsterdam, xii, 1861, p. 46 ; *id.*, Nederl. Tijds. Dierk., i, 1863, pp. 152, 233, 242, 251, 268 ; *id.*, *ibid.*, ii, 1865, pp. 187, 282 ; *id.*, Versl. Akad. Amsterdam (2) ii, 1868, p. 291 ; *id.*, Nederl. Tijds. Dierk., iv, 1873, pp. 138, 337 ; Day, Fish. India, pt. i, 1875, p. 136 ; Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 119, pl. cccxxv, fig. 5 ; Ogilby, Mem. Austr. Mus., ii, 1889, p. 58 ; Weber, in Semon, Zool. Forsch., 1895, p. 264 ; Waite, Rec. Austr. Mus., iv, 1901, p. 54 ; *id.*, *ibid.*, v, 1904, pp. 166, 205 ; *id.*, Synops. Fish. N. S. Wales, 1904, p. 34 ; Stead, Edib. Fish. N. S. Wales, 1908, p. 79.

Bleeker records this fish from no less than 25 localities, namely—Ceram, Amboina, Batchian, Obi-Major, Timor, Flores, Celebes (3), Sangir, Bali, Bawean, Biliton, Thousand Islands, Java (3), Banca (3), Bintang, Singapore, Nias, and Sumatra (2).

Günther¹⁰ states that having examined the type (a dry skin) of Cantor's *Pentapodus nubilus*¹¹ he considers it to be "possibly identical with *Lethrinus nebulosus*." Besides the marked difference in coloration there are also structural differences which throw doubt upon the accuracy of Günther's identification. For instance Cantor's description of the lateral teeth of *Pentapodus* is "velvety, disposed in narrow bands," which could not possibly apply to a *Lethrinus*; again the third anal spine is said by Cantor to be equal to the second, whereas in *L. nebulosus* it is conspicuously longer. For these reasons I have omitted *Pentapodus nubilus* from the synonymy of this species.

Dimensions.—Attains a length of 30 in. and over. Large examples are occasionally taken on the Snapper Banks off Moreton Bay, but are so highly prized by their captors that we have never succeeded in securing one.

Illustration.—Our illustration is taken from a 223 millim. example, captured in Moreton Bay, and purchased by the writer from a Brisbane hawk.

PART VIII.—SPARIDÆ (No. 1).

FAMILY SPARIDÆ.

Sparoides part. Cuvier & Valenciennes, vi, 1830, p. 1.

Sparidæ part. Günther, Brit. Mus. Catal. Fish., i, 1859, p. 412; Jordan & Evermann, Fish. North & Mid. Amer., pt. ii, 1898, p. 1343.

Sparini part. Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 104.

Sparidæ Regan, Ann. & Mag. Nat. Hist. (8) xii, July 1913, p. 124.

"THE SEA BREAMS."

Body compressed, covered with moderate or rather small, adherent, cycloid or feebly ciliated scales. Lateral line complete, not extending on the caudal fin, the tubes simple and straight, not reaching the border of the scale. Head partially scaly, with moderate pointed snout. Mouth terminal and moderately protractile, with rather small, horizontal cleft. Dentition variable, the teeth strong; roof of mouth usually, tongue always, toothless. Opercles unarmed. One dorsal fin, with 10 to 13, rarely 14 (*Box boops*) or 15 (*B. b. caraibica*) strong heteracanthous depressible spines; soft portion of fin naked. Caudal fin usually more or less emarginate, with 17 principal rays, 15 of which are branched. Anal fin rather short, with 3 strong spines, similar to the soft dorsal. Pectorals long and pointed. Ventral thoracic, approximate, pointed, with 5 rays, inserted behind or below the pectoral-base; accessory scale present. Gill-openings large; gill-membranes separate, free from the isthmus; branchiostegals six; pseudobranchiæ well developed; gills four, a slit behind the fourth;

¹⁰ Fisch. d. Sudsee, p. 62, footnote**.

¹¹ Catal. Malay. Fish., p. 49.

gill-rakers moderate; lower pharyngeals separate. Pyloric cæca in small number; intestinal canal short. Distal end of premaxillary ramus overlapping the maxillary externally; premaxillary pedicels not or scarcely extending to the frontals; maxillary more or less expanded forward distally, but without distinct notch in its anterior edge. A strong subocular shelf, developed forwards from the second suborbital and mainly internal to the first. Occipital and parietal crests well developed. Vertebrae 24 (10+14).

Spariform percoids of moderate size, inhabiting the shores of all temperate and tropical seas. These fishes are mostly carnivorous, but some Mediterranean and Atlantic genera, such as *Box* and *Scatharus*, are wholly or partially herbivorous. Though the number of species known from Australian waters is but few, they are of great importance commercially, both because of their general excellence as food, and also on account of their abundance and the facility of capture. The family is well represented in tertiary deposits.

Key to the Subfamilies and Genera.

DENTICINÆ:—Two anterior precaudal vertebrae without parapophyses; first rib sessile.

a¹. Lateral teeth of jaws in a single series, conical i. DENTEX.

SPARINÆ:—All the precaudal vertebrae with parapophyses; all the ribs on parapophyses.

b¹. Lateral teeth of jaws molariform.

c¹. Molar teeth in two series.

c². Molar teeth in three or more series.

DENTEX Cuvier.

Dentex Cuvier, Règne Anim., ed. 1, ii, 1817, p. 273 (*dentex*); Cuvier & Valenciennes, Hist.

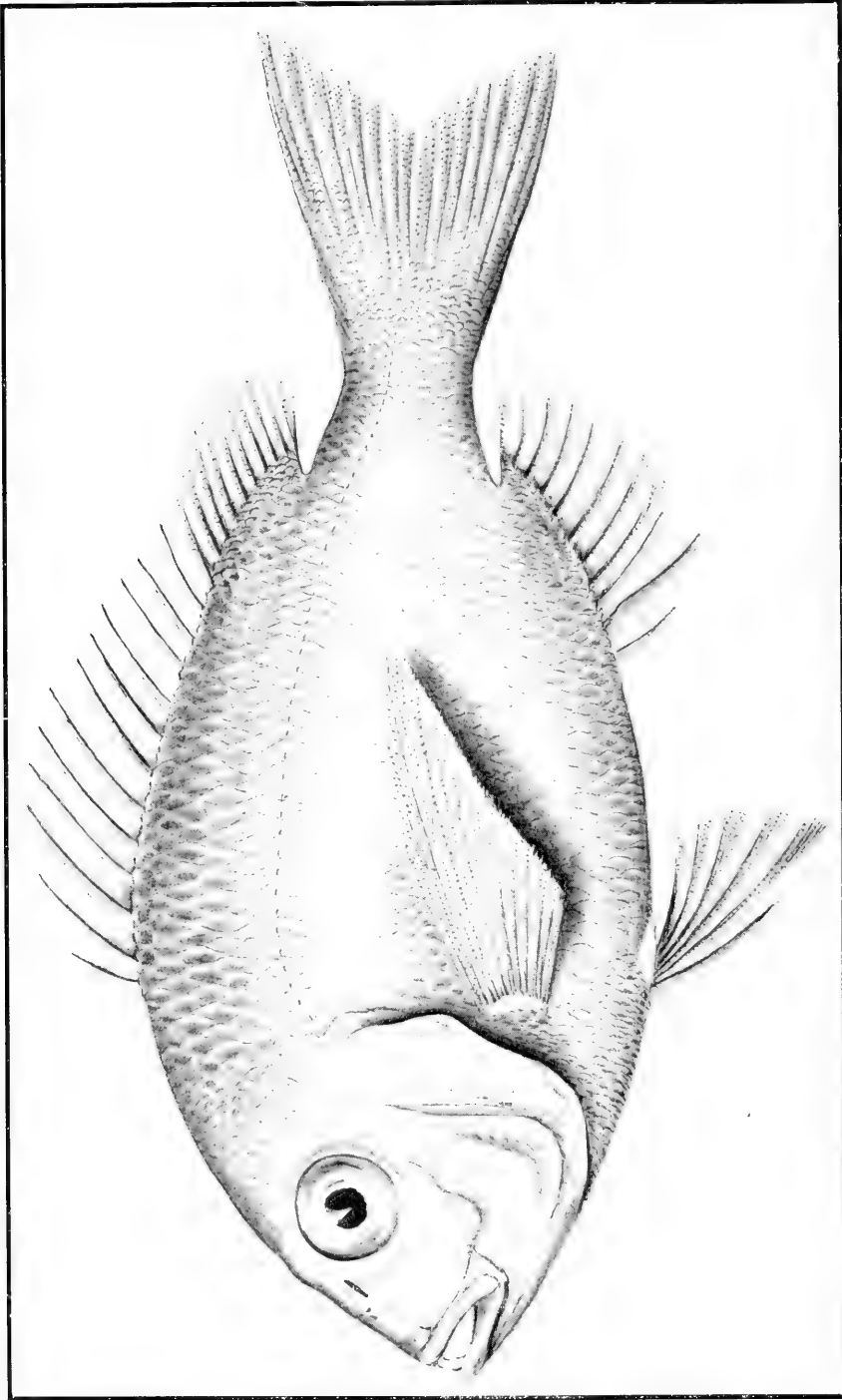
Nat. Poiss., vi, 1830, p. 212; Günther, Brit. Mus. Catal. Fish., i, 1859, p. 266.

Polysteganus Klunzinger, Verh. Zool.-bot. Ges. Wien, xx, 1870, p. 763 (*cæruleopunctatus*).

Synagris (Klein) Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 98. Not Günther 1859.

Body ovate to subovate, compressed. Scales moderate, adherent, finely ciliated. Lateral line complete, not extending on the caudal fin, the tubes with an ascending tubule extending to the border of the scale. Head scaly, except the snout, preorbital, suborbital ring, mandible, and a section of the preopercle. Snout moderate or long; preorbital wide. Cleft of mouth moderate and slightly oblique, the jaws subequal. Jaws anteriorly with two or three pairs of canines, behind which are several series of small sharp teeth; lateral teeth uniserial, strong, and conical. Eye moderate. Nostrils well separated. Opercle with a blunt point. Dorsal fin with x-xii 9-12 rays; spines slender, not or slightly flexible, naked, the soft rays scaly at the base. Caudal deeply emarginate. Anal with iii 8 rays, similar to the dorsal, but the spines much stronger, the 2nd and 3rd subequal. Pectoral long and pointed. Ventral inserted below the pectoral-base, pointed, the outer ray longest. Gill-rakers in moderate number, rather long and slender. Vertebrae 24 (10+14), the precaudals with parapophyses from the third; first rib sessile. (*Dentix*; the ancient name of a Mediterranean fish.)

Marine fishes of moderate size, inhabiting the warmer waters of the Eastern Atlantic Ocean from the South Coast of England to the Cape of Good Hope, round which the range is extended at least as far north as Natal, from the coast of which several species have been described; Mediterranean; Philippines and South Queensland, each one species. Two species from the Red Sea have been separated by Klunzinger under the generic, or subgeneric, title *Polysteganus*.



DENTEX SPARIFORMIS Ogilby. $\frac{2}{3}$ Nat. Size.

Phyllis Clarke, del.

Thirteen or fifteen species are recognized. They are in good estimation for the table.

No other species of *Dentex* being available for comparison I have been obliged to draw up the generic diagnosis from the Queensland fish only, and am uncertain whether some of the characters—such as the form of the lateral line tubes, the separation of the nostrils, the gill-rakers—as given above hold good in the typical species.

DENTEX SPARIFORMIS Ogilby.

Dentex spariformis Ogilby, New Fish. Queensl. Coast, 20 Dec. 1910, p. 91.

CAPE MORETON BREAM.

(Plate XXI.)

Type locality:—36 miles S. 12° W. from Cape Moreton in 73 fathoms.

Body ovate, the dorsal contour much more arched than the ventral, its width 2.65 to 2.85 in its depth, which is 2 to 2.15 in its length and two fifths more than the length of the head. Caudal peduncle about one half longer than deep. its least depth 8.5 to 8.85 in the length of the body. Head a little deeper than long, its upper border linear or feebly concave and strongly declivous to above the anterior border of the eye, with a slight prominence in front of the upper third of the eye; occiput and nape evenly convex; width of head 1.75 to 1.9 in its length, which is 2.7 to 3 in that of the body. Length of snout 2.45 to 2.67 in that of the head. Diameter of eye equal to or a little less than of the snout and 1.6 to 1.9 time its distance from the angle of the mouth. Interorbital region strongly convex, its width 3.5 to 3.66 in that of the head and 1.2 to 1.33 in the eye-diameter. Jaws equal; maxillary extending to below or a little beyond the anterior border of the eye, its length 2.45 to 2.7, that of the mandible 2.25 to 2.4 in the length of the head.

Jaws with bands of villiform teeth and an outer series of stout conical teeth; each with two pair of strong curved canines anteriorly.

Scales in 49 to 51 series above the lateral line, in 5/1/15 or 16 from the base of the first dorsal spine obliquely backwards; cheek-scales in 5 series. Accessory ventral scale lanceolate, its length about two thirds of the eye-diameter.

Dorsal fin with xii 10 rays, originating above the opercular spine, the spines increasing in length to the 4th or 5th, rarely 6th, which is 1.85 to 2.2 in the length of the head and one fourth to two fifths more than the middle rays; succeeding spines gently graded, the last varying from a little longer to a little shorter than the penultimate and three fifths shorter than the longest; soft dorsal one fourth to two fifths longer than high, its length 2 to 2.2 in that of the head. Caudal emarginate, with pointed lobes, the middle rays 1.6 to 1.75 in the upper lobe, which is as long as to one fifth longer than the lower and 3.3 to 3.75 in the body-length. Anal fin with iii 8 rays, the spines strong, the 2nd a little longer and much stronger than the 3rd, 2.25 to 2.75 in the length of the head; soft anal a little longer than high, the 1st ray longest, a little shorter than the 2nd spine. Pectoral fin with 15 rays, its length 2.55 to 2.8 in that of the body; 4th ray longest, extending to the vertical from the last anal spine to the 3rd ray. Ventral inserted below the inferior axil of the pectoral, the spine long and slender, 1.35 to 1.5 in the outer ray, which is the longest, 1.45 to 1.65 in the length of the pectoral, 1.3 to 1.5 in that of the head, and extends to or not quite to the vent.

Gill-rakers 6 or 7 + 12 or 13, well developed, the longest 3 to 3.33 in the eye-diameter.

Upper surface of body pink washed with gold, lower surface and sides silvery. Head above dull red, shading imperceptibly into the paler body-color. Dorsal and caudal fins saffron yellow, the base and lateral borders of the latter pink; anal and ventral fins colorless; pectoral with the upper rays yellow, the lower hyaline. (*Sparus*, an allied genus; *forma*, form.)

Described from nine specimens, measuring from 174 to 250 millim., taken off Cape Moreton, S.Q., on the 3rd of September 1910 during the last cruise of the F.I.S. "Endeavour" in Queensland waters.

Historical.:—Our present knowledge of this handsome fish may be summed up in a very few words. On the date mentioned the trawl was lowered on a bottom of fine sand and mud at a distance of 36.5 miles S. 12° W. from Cape Moreton, the depth being 73 fathoms, and captured, among a number of other species, 141 examples of this sea bream. Nowhere else did the species come under notice, nor have I ever known it to be taken by hook on the Snapper Banks off Moreton Bay.

Uses.:—On the following morning a few were served up for breakfast at the officers' mess, and were unanimously proclaimed delicate and well flavored.

Dimensions.:—To at least 250 millim.

Illustration.:—Our figure is taken from a cotype in the Australian Museum, Sydney.

GYMNOCRANIUS Klunzinger.

Gymnocranius Klunzinger, Verh. zool.-bot. Ges. Wien, xx, 1870, p. 765 (*rivulatus*); Bleeker, Atlas Ichth., viii, pt. 2, 1877, p. 95; Jordan & Thompson, Proc. U. S. Nat. Mus., xli, 1912, p. 568.

Paradentex Bleeker, Arch. Neerl. Sci. Nat., xi, 1876, p. 278 (*microdon*).

Differs from *Dentex* in having the — lateral line extending on the base of the caudal, the tubes simple and straight. Head naked, except the opercle, subopercle, parietal region, and the posterior portion of the cheek. Nostrils approximate. Eye large. Dorsal fin with x 10, anal with iii 10, rays; 3rd anal spine longest.

Marine food-fishes of moderate size and excellent flavor from the Western Pacific; one species from the Red Sea. About six species have been described.

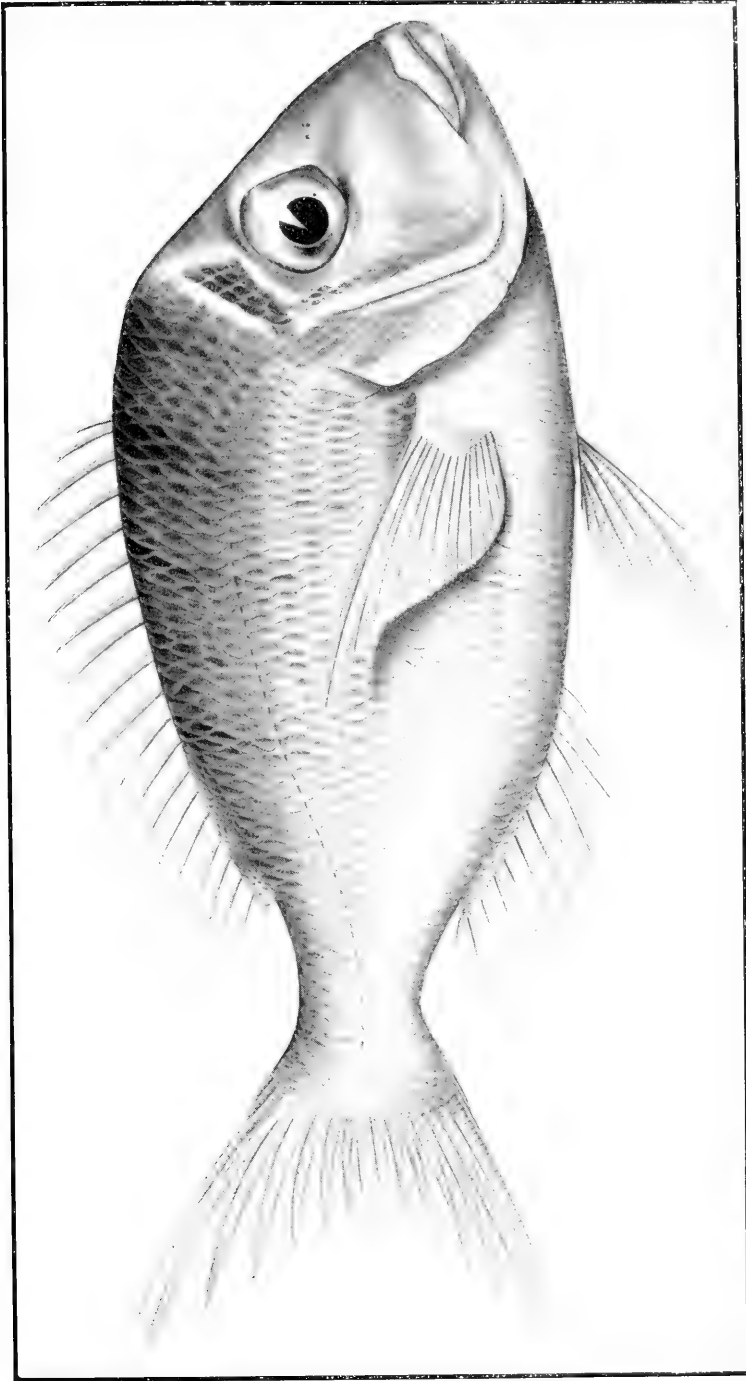
GYMNOCRANIUS AUDLEYI sp. nov.

COLLARED SEA-BREAM.

(Plate XXII.)

Type locality.:—Snapper Banks off Moreton Bay.

Body ovate, the dorsal contour well elevated, its width 2.6 to 2.7 in its depth, which is 2.3 to 2.33 in its length and one fourth more than the length of the head. Caudal peduncle about two thirds longer than deep, its least depth 8.55 to 8.85 in the length of the body. Head a little deeper than long, its upper profile linear and strongly declivous to above the middle of the eye, beyond which is a moderate gibbosity, passing gradually into the almost flat anterior profile of the back, its width 2.15 to 2.2 in its length, which is 2.85 to 3 in the length of the body. Length of snout 1.95 to 2.05 in that of the head.



GYMNOCRANIUS AUDLEYI Ogilby. $\frac{1}{2}$ Nat. Size.

Phyllis Clarke, del.

Diameter of eye 1.45 to 1.55 in the length of the snout and a little more to a little less than its distance from the angle of the mouth. Interorbital region elevated and bluntly cultriform, its width 3.3 to 3.35 in the length of the head and a little more than the eye-diameter. Jaws equal; maxillary extending to below the nostrils, its length 2.85 to 3, that of the mandible 2.4 to 2.45 in the length of the head.

Two pairs of small caninoid teeth anteriorly in the jaws, the outer mandibular pair the largest; lateral teeth but little smaller than the canines, becoming gradually blunter posteriorly.

Scales in 48 series above the lateral line, in 6/1/15 or 16 from the base of the first dorsal spine obliquely backwards; cheek-scales in 4 series, extending upwards to a level with the upper border of the pupil.

Dorsal fin originating above the pectoral-base, the spines increasing in length to the 4th or 5th, which is 3 to 3.25 in the length of the head and 1.6 in the middle rays; succeeding spines gently graded, the last two or even three about equal and one seventh less than the longest; soft dorsal one tenth longer than high, its length two thirds of that of the head. Caudal deeply emarginate with pointed lobes, the middle rays 1.9 to 2 in the upper lobe, which is 3.35 to 3.4 in the body-length. Anal spines strong, the 3rd longest, 3.1 to 3.4 in the length of the head; soft anal one half longer than high, the middle rays longest, one third more than the 3rd spine. Pectoral with 14 rays, its length 3 to 3.2 in that of the body; 2nd ray as long as the 3rd, and extending to above the anal spines. Ventral inserted below the inferior axil of the pectoral, the spine weak and flexible, 1.6 in the outer ray, which is much the longest, 1.25 in the length of the pectoral, 1.33 in that of the head, and extends to the 2nd anal spine.

Gill-rakers 3+5, very short and stout.

Light brown above the lateral line, each scale with a narrow border and often a basal spot of darker brown; sides and belly silvery, the middle area of the upper sides from beneath the middle of to some distance behind the appressed pectoral sometimes with obscure dusky bands. Head above dull violet deepening to lead-color on the snout; cheeks and opercles silvery washed with gold; a broad milk-white nuchal collar, which splits in two on the side of the head, the anterior branch entering the eye and thence passing obliquely backwards to unite with the posterior branch, which passes downwards along the preopercular border; all the scales included between the branches dark chestnut brown in strong contrast with the rest of the head and trunk. Fins colorless. (Named after my friend Audley Raymond Jones, to whom I am indebted for much interesting information regarding the habits of our fishes.)

Described from two specimens taken by hook on the Snapper Banks off Moreton Bay, and measuring respectively 321 and 328 millim.

Reg. No. of type in the Queensland Museum:—I. 14/2138.

Range:—Coast of South Queensland. While the Collared Bream can not be called a rare fish it is as certainly not a common one with us, though apparently generally distributed in suitable localities along our entire coastline. My notes contain particulars of about a score from the Snapper Grounds off Moreton Bay, of one from the Jewfish Shoal off Noosa Head, 5 from Hervey Bay, 3 from the Bunker Group, 1 from Rock-Cod Reef, and 2 from Nor-West Islet. It is, therefore, principally a line fish, and in fact was taken by the trawl on one occasion only during the visit of the "Endeavour"; this happened

at Hervey Bay, where five were taken in one haul on black sand at a depth of 14 to 16 fathoms. Though so far only recorded from the shores of South Queensland it has all the appearance of a northern fish, and I would not be astonished if it should prove to be common further up our coast. This view is also supported by the fact that all the examples which I have handled were of about the same size and, with the exception of the Hervey Bay haul, were taken singly and at long intervals, thus suggesting that they were wanderers.

Uses.—These are excellent fishes for the table, comparing favorably with even the best of our breams.

Dimensions.—Apparently the specimens examined have reached the full size to which the species attains.

Illustration.—Miss Clark's beautiful figure was taken from the type, the larger of the two described examples.

PART IX.—TEUTHIDOIDEA (No. 1).

SUBORDER TEUTHIDOIDEA.

Teuthidoidea Gill, Proc. U. S. Nat. Mus., vii, 1884, p. 276.

The suborder may be defined as follows:—

“Percomorphous teleosts with ovate or subovate body, covered with minute adherent scales; lateral line complete, not extending on the caudal fin. Mouth terminal and but little protractile, with narrow horizontal cleft. Vomer and palatines toothless. Nostrils double. Eyes lateral and high-placed. One dorsal fin; ventrals thoracic and approximate, the inner ray attached by membrane to the wall of the abdomen. Gill-openings moderate; gill-membranes broadly attached to the isthmus; branchiostegals 5 or (in *Monoceros*) 4; pseudo-branchiae well developed; gills 4, a slit behind the fourth; gill-rakers vestigial. Air-bladder present. Intestinal canal with many convolutions; pyloric appendages in small number. Premaxillary and maxillary bones firmly united; entopterygoid present; posttemporals co-ossified with the cranium. Interneurals with transversely expanded buckler-like subcutaneous plates, which intervene between the spines and limit their motion forwards.”

Herbivorous fishes of moderate size from nearly all warm seas, but chiefly abounding within the tropics. They are said to be of excellent quality for the table but, like all weed-eating species, they do not keep well unless they are cleaned as soon after capture as is possible; otherwise the flesh is sure to deteriorate rapidly, and become unfit for food.

Key to the Families.

Scales ctenoid; tail variously armed; anal with 3 or 2 spines; ventral formula i 2 to 5 ..
i. HEPATIDÆ.

Scales cycloid; tail unarmed; anal with 7 spines; ventral formula i 3 i .. ii. TEUTHIDIDÆ.

FAMILY HEPATIDÆ.

Teuthididæ Gill, Proc. U. S. Nat. Mus., vii, 1884, p. 276; Jordan & Evermann, Fish. North & Mid. Amer., pt. 2, 1898, p. 1688.

Acronuridæ Günther, Brit. Mus. Catal. Fish., iii, 1861, p. 325.

Acanthuridæ Jordan & Fowler, Proc. U. S. Nat. Mus., xxv, 1903, p. 350.

"THE SURGEON FISHES."

Teeth in the jaws incisiform, rarely setiform. Nostrils approximate, opening close in front of the eye; a preocular groove. Soft dorsal usually longer than the spinous. Air-bladder bifurcate posteriorly. A more or less developed subocular shelf. Posttemporals trifurcate, the interspaces filled in with bone, so as to appear entire. Vertebrae 21 to 23 (9 or 8 + 12 to 14), the precaudals with strong transverse processes commencing from the first; ribs and epipleurals inserted on the transverse processes.

Herbivorous fishes from nearly all warm seas. Ten genera may provisionally be recognised, five of which have already been recorded from our coasts, while the remaining five, ranging as they do from the Malay Archipelago and New Guinea to the South Seas, may be confidently looked for in our northern waters. The family numbers about 80 species. Great care should be taken in handling these fishes when alive as, by lashing with the tail from side to side, they are capable of inflicting severe wounds with the lancet-like erectile spine, from which they derive their popular name. Representatives of two of the existing genera, *Hepatus* and *Monoceros*, have been found fossil in the Eocene of Europe. Woodward further includes in the family two extinct genera from the same formation, namely *Aulorhamphus* de Zigno and *Apostasis* Kramberger. There are, however, three important characters which separate these extinct fishes from recent hepatids—(1) the form of the lepidosis, (2) the proportional lengths of the divisions of the dorsal fin, and (3) the absence of caudal armature. *Apostasis*, too, has a serrated preopercle, a character quite unknown among living teuthidoids. I think, therefore, that we are justified in viewing with grave suspicion the inclusion of these genera with the *Hepatidae*.

Key to the Subfamilies and Genera.

HEPATINÆ :—Tail armed with a pair of antrorse erectile cultriform spines.

a¹. Jaws with a series of strong fixed lobate incisors.

b¹. Ventrals with 5 soft rays.

c¹. Dorsal with 4 or 5, rarely 3, spines, the soft portion high.

d¹. Snout produced and tubular; dorsal spines strong 1. *Læphichthys*.¹

d². Snout short and deep; dorsal spines weak 2. *ZEBRASOMA*.

c². Dorsal with 9, rarely 7 or 8 spines; soft portion low 3. *HEPATUS*.

b². Ventrals with 3 soft rays 4. *COLOCOPUS*.

a². Jaws with a series of movable setiform teeth, the extremities of which are dilated and serrated 5. *Ctenochaetus*.

MONOCEROTINÆ :—Tail armed with from 1 to 6 pair of fixed laminae.

e¹. Anal with 3 spines, ventral with 5 soft rays.

f¹. Tail with 6 pair of serrated laminae along the median line 6. *Prionurus*.

f². Tail with 3 or 4 pair of keeled laminae 7. *Xesurus*.

e². Anal with 2 spines; ventral with 3 soft rays.

g¹. Adult with two pair of strong keeled caudal laminae; dorsal spines 5 or 6.

h¹. A bony subcylindrical frontal prominence in the adult 8. *MONOCEROS*.

h². No subcylindrical frontal prominence at any age 9. *CALLICANTHUS*.²

g². Adult with a single pair of trenchant caudal laminae; dorsal spines 4 10. *Axinurus*.³

¹ Type, *Acanthurus rostratus*, Günther, Fisch. d. Sudsee, p. 3, 1875, p. 117, pl. lxvi, fig. B.

² This genus is probably inseparable from *Monoceros*, Lacépède's *Naso tuberosus*, with its compressed frontal crest, being intermediate.

³ The italicized genera have not as yet been reported from our coast.

ZEBRASOMA Swainson.

[*Zebrasoma* Swainson, Classif. Fish., ii, 1839, p. 256 (*velifer*); Gill, Proc. U. S. Nat. Mus., vii, 1884, p. 279.

Acanthurus iv. Günther, Brit. Mus. Catal. Fish., iii, 1861, p. 342; D. Day, Fish. India, pt. 2, 1876, p. 203.

Scopas Kner, Reise Novara, Fisch., pt. 2, 1865, p. 512 footnote (*scopas*=*flavescens*).

Tail armed with a pair of antrorse erectile cultriform spines. Snout short and deep. Jaws with a single series of strong fixed lobate incisors. Dorsal fin with 4 or 5, rarely 3, flexible spines, the soft portion elevated, as also is that of the anal. Ventral with 5 soft rays (*Zebra*; *σῶμα*, body: the typical species being transversely banded).

Hepatids of moderate size, inhabiting the warmer parts of the Indian and Pacific Oceans, ranging eastward to Hawaii. About 15 species have been described, but their characters overlap in so perplexing a fashion that it is difficult to determine how many of these are valid. For instance it is generally conceded that the *Acanthurus flavescens* of Günther⁴ and of Jordan and Fowler⁵ is identical with the *A. rhombeus* of Kittlitz⁶ and the *A. scopas* and *A. altivelis* of Cuvier and Valenciennes,⁷ but according to the American authors is probably not *A. flavescens* Bennett.⁸ Be that as it may it is possible that *A. goramensis* Bleeker,⁹ described from an example but 36 millim. long, is the young of the same species, from which also *Zabrasoma agana* Seale,¹⁰ from Guam, can not be separated.

ZEBRASOMA HYPSELOPTERUM (Bleeker).

Acanthurus hypseopterus Bleeker, Nat. Tijds. Nederl. Ind., vi, 1854, p. 327; Günther, Brit. Mus. Catal. Fish., iii, 1861, p. 344; id., Fisch. d. Sudsee, pt. 3, 1875, p. 117; Steindachner, Denk. Ak. Wien, lxx, 1902, p. 494, pl. iv, fig. 1.

Naseus strigatus de Vis, Proc. Linn. Soc. N. S. Wales, ix, 1884, p. 539.

Zebrasoma hypseopteron Ogilby, Mem. Queensl. Mus., iii, 1915, p. 135.

PURPLE-FINNED SAILFISH.

(Plate XXIII.)

Type locality: Larantuka, Flores.

Body ovate, the dorsal profile somewhat more elevated than the ventral, its highest point above the eye, behind which it descends in a long gentle convexity to the peduncle, its width 2.75 in its depth, which is a little less than half (2.05) its length and twice or rather more than twice the length of the head; caudal peduncle slender, a little longer than deep, its least depth 5.5 to 5.75 in that of the body. Head short and deep, about one seventh deeper than long, its upper profile concave from the tip of the snout to the level of the lower border of the eye, above which it is linear and strongly declivous to the nape, which is convex; width of head 1.9 in its length, which is 3.85 to 4.2 in that of the body.

⁴ Brit. Mus. Catal. Fish., iii, 1861, p. 342 (as *A. rhombeus*) and Fisch. d. Sudsee, pt. 3, 1875, p. 116, pl. lxxvi.

⁵ Proc. U. S. Nat. Mus., xxv, 1903, p. 555.

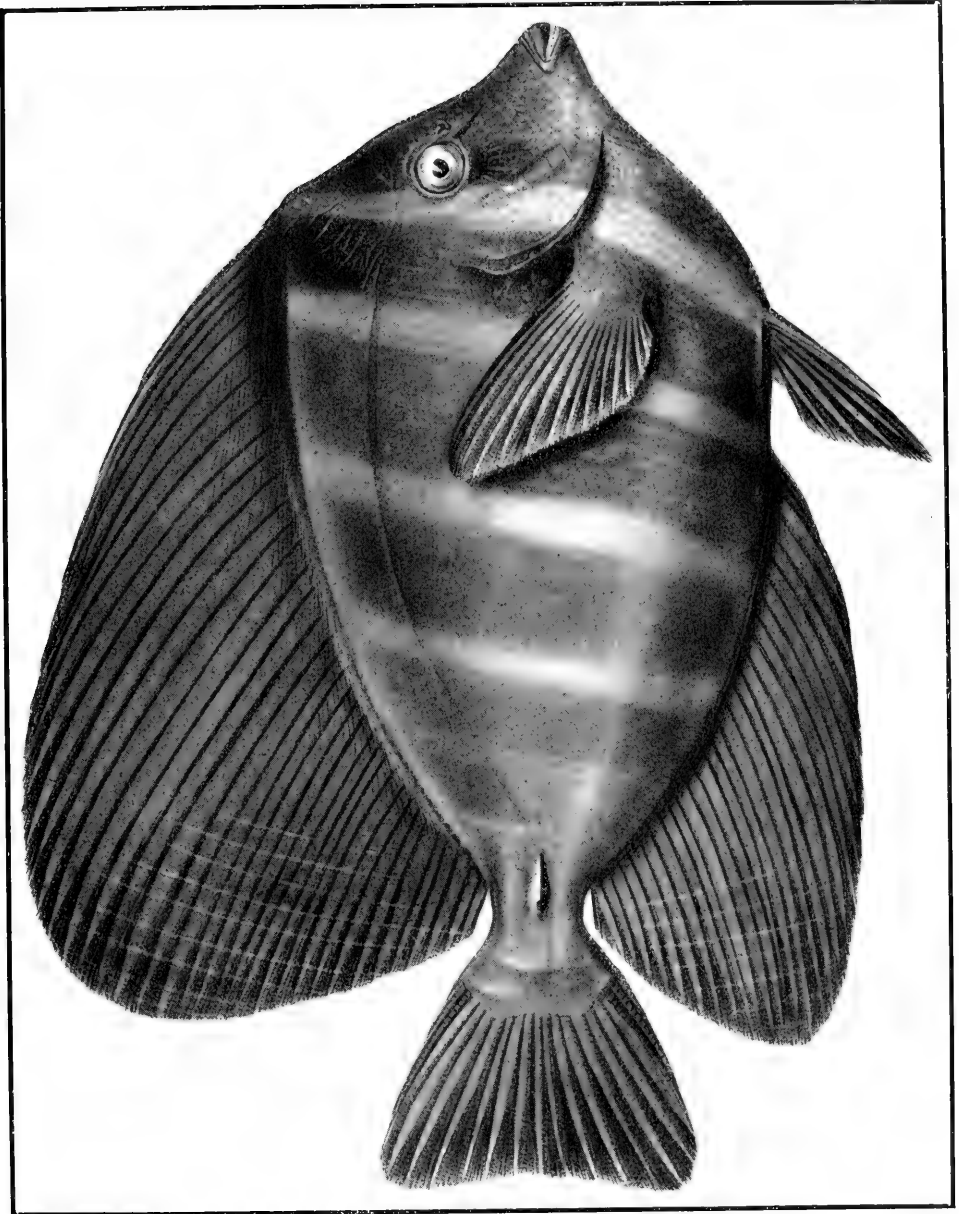
⁶ Museum Senckenberg, i, 1834, p. 196, pl. xiii, fig. 16.

⁷ Hist. Nat. Poiss., x, 1835, pp. 245, pl. cccx, & 249.

⁸ Zool. Journ., iv., 1828, p. 40.

⁹ Nat. Tijds. Nederl. Ind., xv, 1858, p. 208.

¹⁰ Occ. Pap. Bishop Mus., i, pt. 3, 1901, p. 110.



ZEBRASOMA HYPSELOPTERUM (Bleeker). $\frac{1}{2}$ Nat. Size.

Phyllis Clarke, del.

Snout produced and pointed, its length 1.4 to 1.5 in that of the head; preocular groove distinct, hastate. Eye small and high-placed, its diameter 2.85 to 3 in the length of the snout and 4.3 in that of the head; interorbital region as high as wide, elevated in a bony ridge, its width one third more than the eye-diameter and 3.15 to 3.33 in the length of the head. Mouth very small, the space between its angle and the eye 1.8 to 1.95, the depth of the cheek 2.2 to 2.33 in the length of the head. Preopercle with broadly rounded angle, the limbs widely divergent.

Teeth in the jaws with a variable number of blunt cusps, the middle one longer and stronger than the others.

Scales minute, strongly ctenoid, and carinated; caudal spine a little longer than the eye, the scales in front of it not differentiated; postelavicular and supraclavicular bones rather coarsely striated. A series of elongate simple tubes each terminating in a pore below the eye; another series across the inner edge of the opercle; two on the side of the nape, three on the parietal region, and two above the origin of the lateral line, the latter branched. Lateral line rather indistinct, near to and parallel with the dorsal profile, apparently forming a loop above the caudal spine.

Dorsal fin with iv 32 or 33 rays, originating above the hinder border of the eye, its length 1.3 to 1.4 in that of the body; 1st spine very short, the others rising rapidly to the last, which is 1.4 to 1.5 in the longest rays; soft dorsal with rounded outline, the 7th ray longest, one eighth more than the body-depth and 1.75 to 1.9 in the body-length. Caudal fin truncate, with obtusely pointed angles, the middle rays 5.2 to 5.33 in the length of the body. Anal fin with iii 26 rays, originating below the 7th dorsal ray, its length half of that of the body, its outer border obtusely pointed, the 8th to 10th rays the longest, 1.3 to 1.5 in its basal length, which equals the depth of the body. Pectoral fin obtusely pointed, directly obliquely upwards, with 16 rays, the 4th the longest, 3.6 to 3.8 in the body-length. Ventral long and narrow, acutely pointed, inserted below the inferior angle of the pectoral-base, the spine long, slender, and flexible, about two thirds of the outer ray, which is 1.15 to 1.25 in the length of the pectoral, a trifle less than that of the head, and extends to the base of the 4th anal ray: inner ray short, attached for about half its length by membrane to the wall of the abdomen.

Gill-rakers 2+6, very short and slender.

Purplish brown, with six oblique fawn-colored cross-bands about half the width of the interspaces; the first from the nape to the subopercle, entering the eye, and usually continued across the breast to the origin of the ventral; the second from the posterior dorsal spines or anterior rays to the origin of the anal; the third, fourth, and fifth between the bases of the soft dorsal and anal fins; and the sixth, which is much the least conspicuous, between the last rays of those fins. Lower half of head and scapular region profusely spotted with yellow. All the fins blackish, except the tips of the caudal lobes and the lower rays of the pectoral, which shade into brown. (*ὕψηλος*, high; *πτερόν*, fin.)

Described from two fine specimens, measuring respectively 294 and 298 millim., captured at Raine Island, Barrier Reef, and presented to the Queensland Museum by the Wanetta Pearling Co.

Historical.—But little is known of this handsome fish, which was first described by Bleeker from a single small example collected by Hellmuth at Lantanka in the island of Flores. Günther, some twenty years later, was able

to announce the presence in the British Museum of specimens from Samoa, through the Rev. S. J. Whitmee, Mysol, and the Pelew Islands, the latter through the agency of the Godeffroy Museum. He was at the same time responsible for the suggestion that this species was possibly identical with *Acanthurus velifer* Bloch. This I am unable to accept as, for one thing, the color scheme of *Z. hypselopteron* is not only quite distinct from that of *Z. veliferum*, but is constant at all ages, as may be seen from the descriptions of Bleeker's small and my large examples. We next hear of it from the Queensland Coast¹¹ whence de Vis described a young example, about 63 millim. long, as *Nascus strigatus*. The only other record of which I have any cognizance is that of Steindachner, which I only know from the notice in the Zoological Record,¹² where no locality is given.

Uses.—I have no available data as to the value of this species as a foodfish, but Valenciennes, writing of the allied *Z. flavescens* as *Acanthurus scopas*, remarks, on the authority of Valentyn, that "its flesh is of excellent flavor," while, referring to the same fish under the name *A. altivelis*, he makes the curious statement that when "dried and cooked on a gridiron its flavor somewhat resembles that of mutton cutlets."

Range.—From the Austro-Malayan Islands of Flores and Mysol northward to the Pelew Group and eastward to the Coast of Queensland, Raine Island, B.R., and Samoa.

Dimensions.—To at least 300 millim.

Illustration.—Our figure is taken from the smaller Raine Island example.

Reg. No. in the Queensland Museum—I. 14/1713.

FAMILY TEUTHIDIDÆ.

Siganidæ Gill, Proc. U. S. Nat. Mus., vii, 1884, p. 279; Jordan & Fowler, Proc. U. S. Nat. Mus., xxv, 1903, p. 560.

Teuthididæ Günther, Brit. Mus. Catal. Fish., iii, 1861, p. 313.

THE SPINEFEET.

Teeth in the jaws incisiform. Nostrils well separate, opening about midway between the eye and the extremity of the snout; no preocular groove. Soft dorsal much shorter than the spinous. Air-bladder bifurcate both in front and behind. No subocular shelf. Posttemporals forked. Vertebrae 23 (10+13); ribs sessile; parapophyses absent, the epipleurals inserted directly on the ribs.

Herbivorous fishes of small or moderate size from the Indian and Western Pacific Oceans. They are of fair quality for the table, but like their relatives, the Surgeon Fishes, should be handled with extreme caution, since they are able to inflict deep wounds with their many and strong fin-spines; these wounds are said to be exceedingly painful, so much so that they are much dreaded by the fishermen of our coasts. They are very generally known as "Butterfishes" on account of their smooth slippery bodies, but as they share that name with several very distinct species, it has been thought better to substitute a more distinctive appellation. Two genera and about 35 species are recognised.

¹¹ In my "Ichthyological Notes" of last year (Mem. Queensl. Mus., iii, p. 135) I stated that my record was "an addition to the Australian fauna." Further research has shown this to be incorrect, the late Mr. de Vis' announcement antedating mine by more than 30 years.

¹² Vol. xxxix, 1902, Pisces 29.

Note:—Although I am compelled, owing to an irrational law, to subscribe to the aphorism enunciated by Jordan and Metz¹³ with regard to the nomenclature of certain teuthidoid genera, I can not refrain from entering a strenuous protest against a law which forces us into such a position as here occurs. Briefly stated—Gronow in 1765 formed the monomial genus *Hepatus*¹⁴ for the species which was subsequently named *Teuthis javus*¹⁵ by Linnaeus, and of which he gives an unmistakable description and figure. With this species he associates a second, which he separates as “*Hepatus mucrone reflexo utrinque prope caudam*,” but this is a composite species, manufactured from Catesby’s *Turdus rhomboidalis*,¹⁶ a West Indian fish, afterwards named *Chatodon ceruleus*¹⁷ by Schneider, and the *Ikan Maroeke*¹⁸ of Valentyn, an East Indian fish, now known as *Colocopus lambdurus* Gill.¹⁹ Now, since it is inconceivable that a composite species could be used as the type of a genus, it is clear that the true type of *Hepatus* Gronow is *Teuthis javus* Linnaeus, which is not only the first species mentioned by Gronow but also the one species legally available. Jordan and Evermann materially assisted the confusion by stating that *Teuthis hepatus* Linnaeus,²⁰ a species with which Gronow was unacquainted, was the type of his genus. In 1766, one year after Gronow, Linnaeus established the genus *Teuthis*, his first species being named *T. hepatus*, while the second is the *T. javus* above mentioned. *T. hepatus* is a well-known Caribbean fish, said by Jordan and Evermann to be “the most abundant species of the genus” and, therefore, eminently fitted to be the type of the Linnean genus. So far so good; but in 1817 Cuvier, ignoring the simplicity and harmony of this arrangement, must needs step in and turn the whole nomenclature topsy-turvy by selecting Linnaeus’ second species, already the type of Gronow’s *Hepatus*, as the type of *Teuthis*, which he does not even spell correctly; *Acanthurus* Forskal, who formed it for a section of *Chatodon* with *C. unicornis* as the type, as the representative of Linnaeus’ first species of *Teuthis*; and finally in 1829, *Siganus* Forskal is substituted for the *T. javus* group, the Linnean genus being incontinently dropped. I do not think that in all zoological nomenclature a more outrageous instance of mischievous muddling can be brought forward than this which I have here exposed, and I trust that in the near future the International Congress will frame a law, which will permit us to revert to natural conditions, so that *Teuthis javus* may be legally recognised as the type of *Hepatus* Gronow, *T. hepatus* as that of *Teuthis* Linnaeus, and *Chatodon unicornis* as that of *Acanthurus* Forskal.

In order, therefore, to bring this and similar anomalies before the notice of the next Congress, I beg to formulate the following proposition for their consideration, with regard to the law which permitted an individual, in defiance of the original author’s rights, to select any species that suited him as the type of the original genus instead of the first species mentioned—that “a law which creates difficulties where none exist is opposed to reason and common sense and should be deleted.”

¹³ Mem. Carnegie Mus., vi, 1913, p. 44.

¹⁴ Zoophylacium, 1765, p. 113.

¹⁵ Syst. Nat., ed. 12, i, 1766, p. 507.

¹⁶ Nat. Hist. Carolina, &c., ii, 1743, pl. x, fig. 1.

¹⁷ Bloch, Syst. Ichth., 1801, p. 214.

¹⁸ Amboina, iii, 1724, fig. 77.

¹⁹ Proc. U. S. Nat. Mus., vii, 1884, p. 279.

²⁰ Fish. North & Mid. Amer., pt. 2, 1898, p. 1689.

REVIEW OF THE QUEENSLAND POMACANTHINÆ.

SUPPLEMENT No. 1.¹

BY J. DOUGLAS OGILBY.

SINCE the publication of last year's "Memoirs" the following species has been discovered among the Old Collection of the Queensland Museum.

HOLACANTHUS NOX Bleeker.

Holacanthus nox Bleeker, Nat. Tijds. Nederl. Ind., v. 1853, p. 338; id., *ibid.*, xv, 1858, p. 200; Günther, Brit. Mus. Catal. Fish., ii, 1860, p. 51; Bleeker, Verh. Akad. Amsterdam, xvii, 1877, Chétod., p. 131; id., Arch. Néerl. Sci. Nat., xii, 1877, p. 22; id., Atlas Ichth., ix, 1877, p. 62, pl. ceclxviii, fig. 3; Macleay, Proc. Linn. Soc. N. S. Wales, vii, pt. 2, 1882, p. 244.

Type locality:—Amboina.

Depth of body 1.7 in its length; dorsal contour rather more elevated than the ventral, its anterior profile linear and strongly acclivous to above the hinder border of the eye, thence by a moderate convexity to about the 4th dorsal spine, beyond which it descends in a long gentle curve to the middle of the soft dorsal, whence it bends more abruptly downwards to the caudal peduncle; ventral contour evenly convex from the chin to the anal, the base of which is similarly convex; least depth of peduncle 6.9 in the length of the body. Width of head 1.6 in its length, which is 1.25 in its depth and 3.65 in the body-length. Diameter of eye a little more than the length of the snout, which is 2.9 in that of the head; interorbital region a little wider than deep, its width 1.15 in the eye-diameter. Maxillary extending to below the anterior nostril. Preorbital coarsely denticulated, its width 1.4 in the eye-diameter. Hinder limb of preopercle vertical and strongly denticulate; the lower limb with three graduated teeth posteriorly, the strongest next to the spine, which is long and feebly curved, 1.75 in the length of the head and extends to below the pectoral-axil.

Scales similar to those of *H. bicolor*, in 48 series above and beyond the lateral line, in 6/1/22 between the spinous dorsal and the vent; squamulæ absent. Lateral line with 30 open pores, terminating below the middle of the soft dorsal.

Dorsal fin originating above the opercle, with xv 15 rays, the soft portion 2.1 in the length of the spinous; spines graduated, the 1st well developed, 1.85 in the last, which is 1.5 in the longest ray and 5.3 in the body-length; soft dorsal with acutely pointed outline, the 10th ray longest, extending to above the middle of the caudal, its hinder border linear. Caudal fin rounded, the middle rays longer than the outer and 4.3 in the length of the body. Anal fin with iii 17 rays, originating below the 11th dorsal spine, the 1st spine 1.6 in the last, which is 1.2 in the longest ray; soft anal similar to but longer and blunter than the soft dorsal. Pectoral with 16 rays, its length 3.5 in that of the body, the 5th ray

¹ Mem. Queensl. Mus., iii, 28 Jan. 1915, pp. 99-116.

longest, extending to below the 7th dorsal spine. Ventral a little longer than the pectoral, the spine 1.65 in the outer ray, which is not produced, is 3.35 in the body-length, and extends to midway between the vent and the anal.

Body and fins dark brown, except the spinous dorsal which, with the head, is strongly tinged with yellow, and the interradi al membrane of the ventral, which is nearly black.

Etymology.—Lat: *nox*, night, in allusion to its sombre coloration.

Reg. No. in Queensland Museum of specimen described—I. 14/2286.

Measurements of the unique Queensland example:—See below.

Range.—From the Moluccas eastward to the Gulf of Papua and the Barrier Reef.

This angel-fish, which is apparently of rare occurrence everywhere, was first described by Bleeker from a single example obtained at Amboina. Subsequently the same observer obtained three others from Goram. To the eastward Goldie collected a fifth specimen at or near Port Moresby, B.N.G., as recorded by Macleay. The example here described was collected by Mr. Kendall Broadbent probably in the neighbourhood of Cooktown, N.Q., whence the bulk of his collections labeled "Barrier Reef" came. The species was correctly identified by the late Mr. Charles W. de Vis, who, however, has not left any notice of its occurrence. These six form the only records of which I can find any account.

Dimensions.—A small species, the largest recorded only 111 millim.

In the table of measurements² this species would come between *H. flavissimus* and *H. bicolor*; from the former it differs in its habit and in the presence of an extra dorsal spine, from the latter, irrespective of coloration, in the absence of squamulæ. Following are the measurements of the Queensland example in terms of the previous table.

Length from tip of longer jaw to that of caudal fin in millimeters—85.

Expressed in hundredths.

From tip of snout to base of middle caudal rays—100; greatest depth of body—59.4; least depth of caudal peduncle—14.5; greatest width of head—17.4; greatest depth of head—34.7; from tip of snout to end of bony opercle—27.5; from tip of snout to eye—9.4; horizontal diameter of eye—10.4; width between middle of eyes—9.1; height above middle of eyes—8.9; between eye and angle of mouth—5.3; length of preopercular spine—15.5; basal length of spinous dorsal—50; basal length of soft dorsal—24; length of first dorsal spine—10.1; length of last dorsal spine—18.8; length of longest dorsal ray—28; length of middle caudal rays—23.2; length of outer caudal rays—20.3; length of first anal spine—12.8; length of last anal spine—20.2; length of longest anal ray—22.5; length of soft anal—28.3; length of pectoral fin—29; length of ventral spine—18.1; length of ventral fin—29.7.

CHÆTODONTOPLUS DUBOULEYI (Günther).

Holacanthus darwiniensis Kent, Proc. Roy. Soc. Queensl., vi, 1890, p. 235.

Type locality.—Darwin, N.T. (*H. darwiniensis*).

On the 8th of April of the current year we received from Mr. L. H. Maynard of Bundaberg, to whom we are already indebted for many valuable

² Ibid., p. 116.

donations, a magnificent specimen of this beautiful fish, together with a newspaper clipping recording the circumstances of its capture, and a rough sketch showing the life-colors of the fish, which conclusively proclaims it to be one of the most gorgeous fishes of any seas.

From the cutting we gather that the fish was washed ashore at the feet of Mr. Harold White, while watching the surf bathers in Hervey Bay, and was promptly annexed by him and brought to Mr. Maynard.

The example proves to be the largest on record, measuring over all 195 millim., and is for this reason of peculiar value as affording the opportunity to study the variations in form consequent on increasing age, the results of which are embodied in the following notes, which should be compared with our previous description.³

"Depth of body 1.7, of caudal peduncle 7.67 in the length of the body; diameter of eye 1.25 in the length of the snout and a trifle more than the inter-orbital width; preopercular spine much shorter, 3.1 in the length of the head and not nearly reaching to the level of the pectoral. Dorsal fin with 20 rays, the last spine 4.35 in the body-length." The other characters vary but little.⁴

In life the ground-color is imperial purple shading gradually into the deep violet of the abdominal region, the nuchal-ventral collar, the dorso-caudal band, the caudal, pectoral, and ventral fins, and a broad band round the jaws chrome-yellow; all the dark part between the dorsal profile and the pectoral is profusely ornamented with yellow spots, while below that fin right to the caudal these are replaced by an interlacing network of narrow bars; the blue dorsal and anal bars are much more numerous and of a more intricate pattern than is shown in McCulloch's figure.

The locality constitutes a new record for Queensland.

³ Ibid., p. 112.

⁴ The lower lateral line previously referred to is not present in this fish, and should be omitted from the amended description.

ICHTHYOLOGICAL NOTES (No. 3).

BY J. DOUGLAS OGILBY.

SELACHII.

ORECTOLOBIDÆ.

ORECTOLOBUS DEVISI nom. nov.

So long ago as 1883 the late Mr. Charles W. de Vis described an *Orectolobus* from Moreton Bay under the name *Crossorhinus ornatus*. This name was at first considered to be a synonym of *O. maculatus* (= *barbatus*) by myself and others. Subsequently, however, its validity was recognized by Messrs. Tate Regan, McCulloch, and the writer, the species duly appearing in our respective reviews of the *Orectolobidæ* as *O. ornatus*.¹ I now find that Bonaparte, under his genus *Orectolobus*, 1834, listed Gray's *Scyllium ornatum* (= *Chiloscyllium plagiosum* Bennett) as *Orectolobus ornatus*, thus invalidating de Vis' choice. I take, therefore, a melancholy pleasure in renaming the species after my old friend.

HYPOSTOMIDES.

PEGASIDÆ.

PEGASUS VOLITANS Linnæus.²

The Queensland Museum has received, during the past year, a specimen of this sea-dragon through the kindness of Mrs. Tarnaros, whose husband brought it home from the Solomon Islands. This is the most easterly locality from which the species has as yet been recorded, but it had been obtained by Peters from New Britain as long ago as 1876.³ As regards *Zalises umitengu* Jordan & Snyder,⁴ founded on a single "dried specimen 75 millimeters long," I hardly think the characters given will bear scrutiny. The authors rely principally on "the longer and narrower snout and rather longer tail." A comparison between their description of these characters and the six examples now before me (Coast of Queensland five, Solomons one) is instructive. In the type of *Z. umitengu*, in which it is claimed that the snout is "longer than in any other species," the proportional measurement of the snout to the body-length is stated to be as 1 to 5; in my Queensland specimens this measurement varies from 1 to 4 to 1 to 4.75, in the Solomons specimen as 1 to 4.6; in all these examples, therefore, the snout is longer, and in some much longer, than in the Japanese fish.⁵ The width of the snout to its length in front of the mouth is similarly variable. The length of the tail as compared with the head and trunk is not reliable. Günther⁶ computes it as being equal to the distance between the posterior margin of the eye and the vent.

¹ Regan, Proc. Zool. Soc., 1908, i, p. 347.

Ogilby & McCulloch, Proc. Roy. Soc. N. S. Wales, xlii, 1908, p. 264.

² Syst. Nat., ed. 10, i, p. 338.

³ Mon. Akad. Berlin, 1876, p. 843.

⁴ Proc. U. S. Nat. Mus., xxiv, p. 2.

⁵ The exact proportions for the Queensland specimens are as 1 to 4, 4.15, 4.2, 4.6, 4.75.

⁶ Brit. Mus. Catal. Fish., viii, p. 147.

Jordan and Snyder as equal to that between the latter and the anterior margin of the eye; in the Queensland fishes it is invariably longer than Günther's measurement but not quite so long as Jordan's, while in the Solomons fish it is considerably shorter. I consider, therefore, that it is impossible to recognise a species founded on characters so inconstant, and I, therefore, unhesitatingly refer *Z. umitengu* to the synonym of *P. volitans*.

PERCOMORPHI.

SERRANIDÆ.

CALLANTHIAS ALLPORTI Günther.⁷

A specimen of this handsome fish is in the collection of the Amateur Fishermen's Association; it was captured on the Snapper Grounds off Cape Moreton, and is the most northerly record for the species.

CHEILODIPTERIDÆ.

AMIA FLEURIEU (Lacépède).⁸

The same collection contains a fine example of this fish obtained at Darnley Island by Dr. J. R. Tosh, which is, I believe, the only Australian specimen yet recorded, though Macleay had previously listed it from Port Moresby, B.N.G., under the name *Apogon aureus*.⁹

? CENTROPOMIDÆ.

GLAUCOSOMA MAGNIFICUM (Ogilby).

In the 3rd volume of these Memoirs I described and figured, as *Reganichthys magnificus*,¹⁰ a fish which I placed provisionally in the family Pempheridæ. On receipt of my paper Mr. Tate Regan kindly wrote to me suggesting that my fish was a *Glaucosoma*, and this on re-examination I found to be the case. The great superficial resemblance to *Pempheris* and *Schuetitia*, combined with its dissimilarity, until closely compared, to our common Epulette Fish or Pearl Perch (*G. scapulare*),¹¹ quite deceived me, and I have to thank Mr. Regan for giving me this opportunity of correcting my mistake.

LUTIANIDÆ.

CÆSIO CHRYSOZONA Kuhl & v. Hasselt.¹²

A fine specimen is in the Amateur Fishermen's Museum; it was captured in Moreton Bay.

APRION MICROLEPIS Bleeker.¹³

The Queensland Museum possesses a fine example of this fish, measuring 395 millim. It was identified by Mr. de Vis as *A. pristipoma*,¹⁴ and was pre-

⁷ Ann. & Mag. Nat. Hist. (4) xvii, 1876, p. 390.

⁸ Hist. Nat. Poiss., iv, p. 24.

⁹ Proc. Linn. Soc. N. S. Wales, vii, p. 236.

¹⁰ Mem. Queensl. Mus., iii, p. 123.

¹¹ Ramsay, in Macleay, Descr. Catal. Austr. Fish., No. 68 (Proc. Linn. Soc. N. S. Wales, v, 1881, p. 334).

¹² Cuvier & Valenciennes, Hist. Nat. Poiss., vi, p. 440.

¹³ Verh. Akad. Amsterdam, xiii, p. 94.

¹⁴ Ibid., p. 96.

sented to the Museum by Mr. A. E. Wood, who obtained it in Moreton Bay. This fish was originally described from Amboina and is apparently rare in collections, as I have been unable to find any further record of it under Bleeker's name. It is, however, of special interest to Australian ichthyologists, as it is without a doubt identical with the fish described by Castelnau from Port Jackson thirty-six years ago as *Aphareus roseus*,¹⁵ and which has not been rediscovered until now; his specimen measured about 600 millim.

MULLIDÆ.

MULLOIDES AURIFLAMMA Forskal.¹⁶

When I first recorded the occurrence of this fish in our waters in 1908,¹⁷ I only knew of the ordinary yellow-banded form. In my "Endeavour" notebooks I find, however, the following entry, which is worth noting—"in a few cases the yellow lateral band was replaced by one of bright red." These were taken in Hervey Bay.

CHÆTODONTIDÆ.

CHELMONOPS TRUNCATUS (Kner).¹⁸

Occurs as far north as Double Island Point, S.Q., where a single specimen was trawled at a depth of 33 fath.

CHEILODACTYLIDÆ.

GONIISTIUS VESTITUS Castelnau.¹⁹

I can not agree with Macleay that this species is identical with the Hawaiian *G. vittatus*.²⁰ In all the specimens which I have seen from Moreton Bay, the dark dorso-lateral band is continued unbrokenly to the tip of the lower caudal lobe, which it completely covers, as described by Castelnau. Neither am I quite satisfied as to the necessity for separating *Goniistius* from *Cheilodactylus*.

DACTYLOPAGRUS.

McCulloch²¹ has used the generic name *Dactylosparus* for *Cheilodactylus carponemus* and its allies. No blame can be attached to this gentleman for, as in the subsequent case of *Pagrosomus* and *Sparosomus*,²² the mistake was entirely due to Gill's carelessness in forming two different names for the same species in the same paper. The synonymy here given shows that *Dactylopagrus* is the correct name; since it is quite distinctly defined, which *Pagrosomus*, though widely employed, is not.

Dactylopagrus Gill, Proc. Acad. Nat. Sci. Phila., 1862, p. 114.

Dactylosparus Gill, ibid., p. 117.

¹⁵ Proc. Linn. Soc. N. S. Wales, iii, p. 373.

¹⁶ Deser. Anim., p. 30.

¹⁷ Proc. Roy. Soc. Queensl., xxi, p. 21.

¹⁸ Sitz. Akad. Wien, xxxiv, p. 442.

¹⁹ Proc. Linn. Soc. N. S. Wales, iii, p. 377.

²⁰ Günther, Fisch. d. Sudsee, pl. 51, fig. B.

²¹ Zool. Res. Endeavour, i, p. 65.

²² Nat. Acad. Sci. Washington, vi, pp. 97, 116, 123.

LABRIDÆ.

LEPIDAPLOIS PERDITIO (Quoy & Gaimard).²³

Not uncommon on the Snapper Banks off Moreton Bay, and greatly prized for its edible qualities.

LEPIDAPLOIS MESOTHORAX (Schneider).²⁴

The Queensland Museum possesses a small example of this handsome labrid, taken on the Barrier Reef by Mr. Kendall Broadbent.

NOVACULICHTHYS JACKSONENSIS (Ramsay).²⁵

There is a fine specimen in the collection of the Amateur Fishermen's Association of Queensland, caught in Moreton Bay.

HEPATIDÆ.

HEPATUS TRIOSTEGUS (Linnaeus).²⁶

This widely distributed fish occurs, as might be expected, on the Queensland Coast. The late Mr. de Vis described it as new from the Duke of York Island under the name *Acanthurus zebra*,²⁷ overlooking the fact that Lacépède had already bestowed on it the same synonymic title.²⁸

ELEOTRIDÆ.

KREFFTIUS AUSTRALIS (Kreffft).²⁹

This gudgeon ranges at least as far north as the Logan River, S.Q., whence a specimen was brought for identification to the Amateur Fishermen's Association by Mr. C. Harris.

BLENNIIDÆ.

BLENNIUS TASMANIANUS Richardson.³⁰

I can find no definite record of this little fish as a native of Queensland, nevertheless it is not uncommon in Moreton Bay and southwards.

²³ Voy. Astrolabe, Poiss., p. 702.

²⁴ In Bloch, Syst. Ichth., 1801, p. 254.

²⁵ Proc. Linn. Soc. N. S. Wales, vi, p. 198.

²⁶ Syst. Nat., ed. i, p. .

²⁷ Proc. Linn. Soc. N. S. Wales, viii, p. 447.

²⁸ Hist. Nat. Poiss., iv, p. 546.

²⁹ Proc. Zool. Soc. London, 1864, p. 183.

³⁰ Trans. Zool. Soc. London, iii, p. 122.

STROMATEIDÆ.

NOMEUS GRONOVII (Gmelin).³¹

Though recorded by Waite³² more than twenty years ago from the neighborhood of Sydney, no definite announcement of its occurrence in our waters has yet been made. It is, therefore, with pleasure that I can record a fine example from Moreton Bay, which is in the collection of the Amateur Fishermen's Association, to which it was presented by Mr. A. J. Thorpe.

LEIRUS MACULATUS (Günther).³³

Like the preceding this pretty little fish has been known for many years from the New South Wales Coast, having been recorded first by me³⁴ and afterwards by Waite from the Port Jackson District. A specimen is in the same Association's collection from Moreton Bay.

PLECTOGNATHI.

BALISTIDÆ.

PSILOCEPHALUS BARBATUS (Gray).³⁵

The only Queensland example, of which I have knowledge, was trawled by the "Endeavour" in Platypus Bay.

³¹ Syst. Nat., i, p. 1205.

³² Proc. Linn. Soc. N. S. Wales, xix, p. 219.

³³ Brit. Mus. Catal. Fish., ii, p. 412.

³⁴ Rec. Austr. Mus., ii, p. 65.

³⁵ Zool. Misc., p. 8.

HELMINTHOLOGICAL NOTES.

By T. HARVEY JOHNSTON, M.A., D.Sc., C.M.Z.S.,

Hon. Zoologist Queensland Museum ;

Walter & Eliza Hall Fellow in Economic Biology, University of Queensland.

OPHIOTÆNIA LONGMANI, n. sp.

(Text-figures 1-18.)

SOMEWHAT macerated individuals of this new species of tapeworm were taken by Mr. H. A. Longman, of the Queensland Museum, from a preserved specimen of *Aspidiotes ramsayi*, a python captured at Yeulba in Western Queensland. In addition to the cestode, the intestine was found to contain a large species of *Ascaris*, while the lungs were parasitised by a few specimens of *Porocephalus*.

The longest of the tapeworms measures 94 mm. and possesses a maximum breadth of almost one millimetre. The scolex has a width of about .8 mm. and is nearly square in section, its dorsoventral diameter being about .65 mm. It is well marked off from the rest of the strobila. Its broadest part is situated

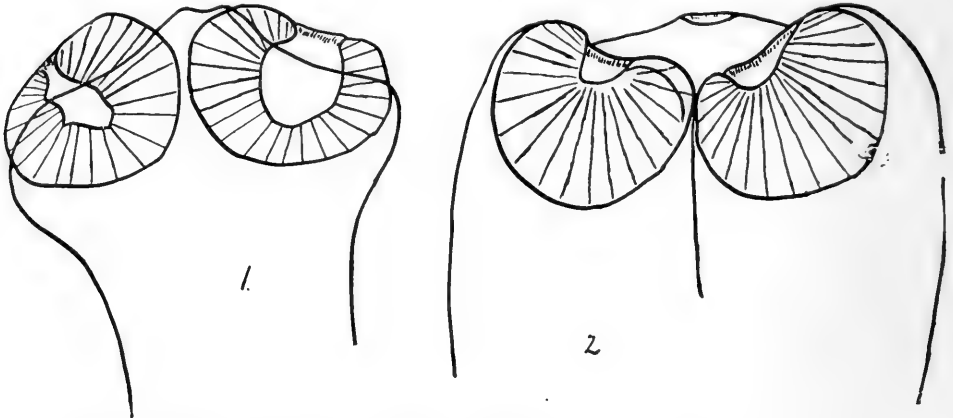


Fig. 1.—View of scolex of *Ophiotænia longmani*.

Fig. 2.—Side view, showing apical depression, also lateral groove between the suckers.

anteriorly. (Figs. 1, 2.) The suckers are so placed that they face forwards and at times slightly inwards. As the apical region is quite small and scarcely, if at all, projects beyond the suckers, the front of the scolex is rather flat and rectangular, reminding one of the appearance of the scolex of *O. punica* Chodok. (La Rue 1914, pl. 13, fig. 153.) The suckers are prominent, strongly muscular, slightly petiolate organs, and, as already stated, their cavities are directed anteriorly. There is a well-marked furrow between the suckers dorsally, laterally and ventrally, the dorsal and ventral grooves being longer than the lateral furrows, the former two terminating in the anterior neck region, while the

latter disappear just behind the level of the base of the suckers. Each sucker has a diameter of about .35 to .4 mm., and possesses a deep concavity. An apical sucker is absent, though a slight terminal depression can be seen on the scolex (fig. 2), and into it are inserted a few weak muscle fibres. The cuticle of the scolex is smooth and thin, though somewhat thicker on the suckers than on the rest of the scolex.

The neck region is about .7 mm. in its narrowest part, the strobila gradually widening, until mature segments reach a breadth of about 1.4 mm. and a length of about 2 mm. The proglottids are rectangular, being at first broader than long but later become squarish and ultimately longer than broad. Segmentation is not readily visible, the parasite having the appearance of a thin, narrow piece of tape. Genital pores alternate irregularly and there is no definite genital papilla.

The cuticle of the strobila is very thin and practically smooth. The subcuticula possesses very closely set and well-developed longitudinal muscle

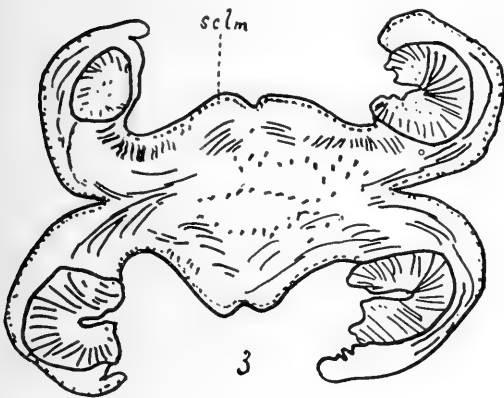


Fig. 3.—Transverse section of the anterior end of the scolex, showing subcuticular longitudinal muscles (*s.c.l.m.*), also the musculature of the parenchyma and suckers.

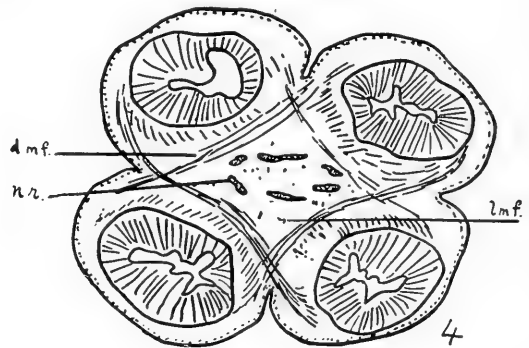


Fig. 4.—Section through scolex in vicinity of nerve-ring (*n.r.*), showing diagonal muscle fibres (*d.m.f.*).

bundles arranged in a series next to the cuticle and occupying a zone of about .04 mm. in width (figs. 9, 17). The cortex contains numerous calcareous corpuscles, varying in size from .15 to .08 mm. in long diameter by .08 to .04 mm. in short diameter, and averaging about .06 by .04 mm. (Fig. 9.)

Muscular System.—The main musculature lies inwardly from the zone containing the calcareous bodies. The longitudinal muscles are well developed especially in the scolex and neck, while the transverse fibres are very weak and often not recognisable, nor are the dorsoventral fibres well marked.

The longitudinal musculature of the segments forms a well-defined ring consisting of numerous small bundles arranged more or less in a single series, though not infrequently isolated bundles lie inwardly from this ring (text-figs. 13, 17), and in places the arrangement is such that there appears to be an inner and an outer series (fig. 17).

A powerful sphincter surrounds the common genital atrium (figs. 11, 14).

The musculature of the neck and scolex calls for notice. In the anterior neck region, the longitudinal muscles are very abundant and are seen, in transverse section, to be cut transversely as well as obliquely (text-fig. 8), as they pass forwards to become inserted into various parts of the scolex. There is a well-defined zone containing the muscles (text-fig. 7), and this lies just within the region provided with calcareous corpuscles. It occupies the whole central region, though the fibres are rather less abundant in the centre of the section and in the immediate vicinity of the nerves and excretory vessels. The bundles

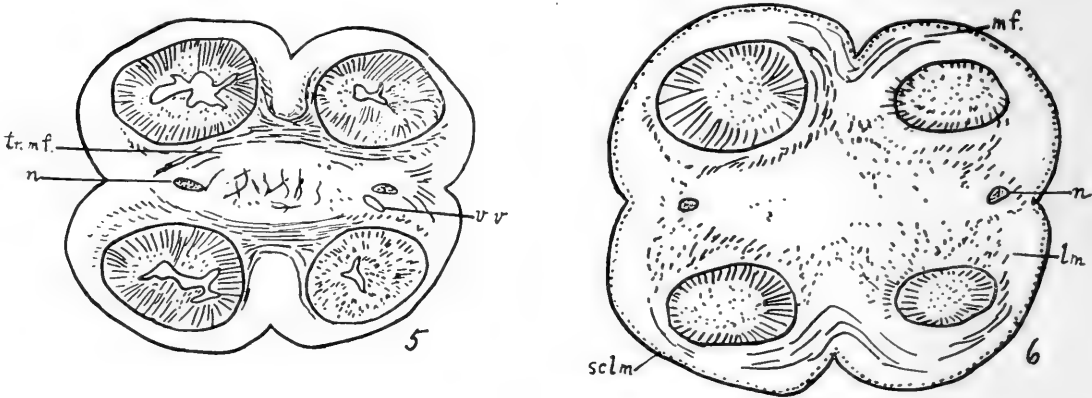


Fig. 5.—T.S. posterior region of scolex, showing transverse muscle fibres (*tr.m.f.*). *v.v.* = ventral excretory canal.

Fig. 6.—T.S. behind fig. 5, showing disposition of the longitudinal muscles (*l.m.*), also the presence of weak transverse fibres (*m.f.*) in the cortex dorsally and ventrally.

elsewhere are strongly developed and very numerous, so that there is practically no differentiation into medulla and cortex within the muscular zone, though the outer cortical area is well defined since it is free from muscular fibres and contains calcareous corpuscles. In this region certain of the excretory canals (the dorsal) have their walls well supplied with longitudinal muscle fibres (fig. 9). There is no definite arrangement of the muscles in the neck region.

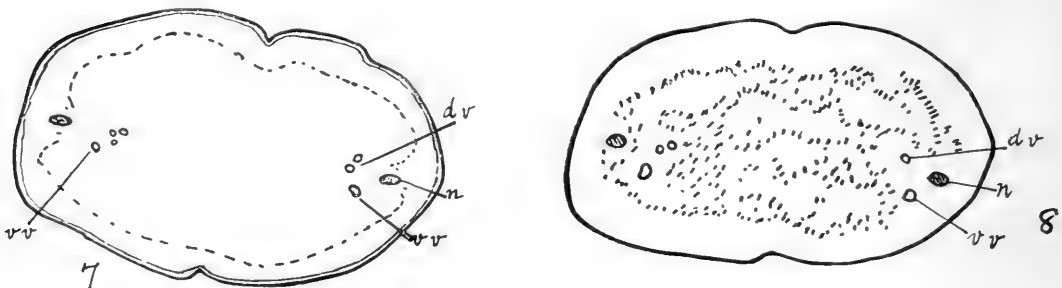


Fig. 7.—T.S. neck, showing two dorsal excretory canals (*d.v.*) on one side and three on the other. The outer limit of the longitudinal musculature is shown by the dotted line. *v.v.* = ventral excretory vessels.

Fig. 8.—T.S. neck posteriorly to Fig. 7, showing arrangement of the excretory vessels and muscles. There are two dorsal canals on one side and one on the other.

In transverse sections of the anterior end of the scolex, the musculature is seen cut transversely and obliquely. Some of the fibres are inserted into the apical region of the rostellum and diverge as they pass posteriorly, appearing in the central region of the rostellum (fig. 3). Outwardly from these are more or less transverse fibres which are inserted into the base of the suckers, and just behind this area they become rather diagonally arranged as shown in fig. 4. Lying internally from these are relatively few longitudinal fibres and the nerve-ring. Just posteriorly, the arrangement of the musculature is as shown in fig. 5, the obliquely transverse series now becoming a well-developed band of transverse fibres situated dorsally and ventrally, each band connecting the inner and lower portions of the two suckers of the respective surfaces. The arrangement and position of these bands is such as to suggest that their contraction may cause the outer parts of the suckers to move away from each other. Some of the oblique fibres are still seen in the section (fig. 5). Within the transverse bands are the longitudinal musculature as well as less strongly developed fibres arranged irregularly and traversing the medulla.

At about the level of the base of the suckers (fig. 6) the longitudinal series becomes much more evident, and can be seen aggregated particularly around the inner margins of the suckers. Fibres also lie scattered in the medulla, and there are weak ring-fibres situated outwardly from the sucker region in the loose cortex below the subcuticula.

Nervous System.—The nerve-ring (fig. 4) lies between the suckers at about the level of the base of their concavities. In the neck and strobila the longitudinal nerve of each side lies dorsolaterally to the main excretory canal and apparently dorsally to the sex-ducts.

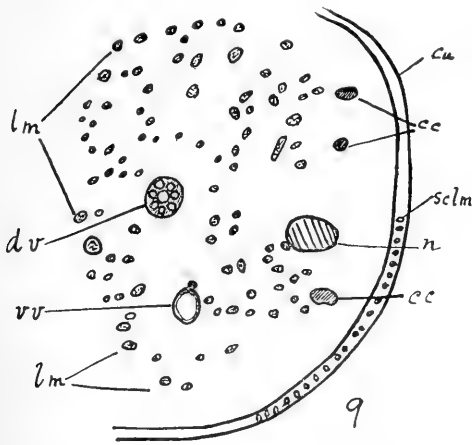


Fig. 9.—Portion of a transverse section in the vicinity of that shown in fig. 8, showing detailed structure of cortex and excretory vessels. Lettering as in previous figures—*cc.*, calcareous corpuscles; *cu.*, cuticle.

Excretory System.—The state of preservation of the specimens does not allow of the tracing of the excretory system forwards beyond the anterior part of the neck, with any certainty. The ventral vessel apparently forms a loop just behind and outwardly from the nerve-ring. The dorsal canals do not extend into the proglottids but can be recognised in sections of the neck (figs 7, 8, 9), and their walls, as already stated, are provided with a ring of strong muscular fibres like those of the rest of the scolex and neck. The ventral vessel of each side has a much wider lumen and possesses thin walls. In the specimen sectioned, the dorsal canals show the following arrangement in the scolex and neck. On the right side in the posterior part of the scolex there are three excretory ducts, but only two on the other (fig. 7). Two of each side

eventually fuse in the neck so that there come to be, in addition to the ventral canal, one dorsal vessel on the left side and two on the right (fig. 8). This

arrangement continues for a little distance, the single dorsal canal of the left side dividing to form two but these eventually rejoin so that there are two and one of these canals respectively, as before. Their further arrangement was not traced in the series, but in sections of segments no sign of any dorsal vessels was recognised. The ventral duct of each side is rather large, and is situated ventrally to the vitelline region. It passes below the outer ends of the sex-ducts.

Male Reproductive System.—The testes are very numerous and are restricted to two wide lateral fields between the uterus and the vitelline follicles, and extending from the anterior border of the ovary almost to the anterior end of the segment. They are absent above the cirrus sac and *vas deferens*, which occupy practically the whole of the medulla in that region. The testes lie rather

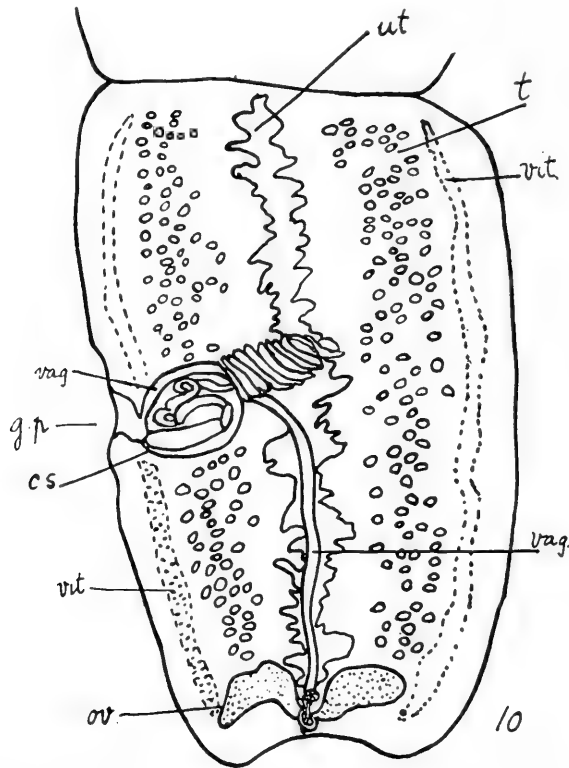


Fig. 10.—A mature segment. *c.s.*, cirrus sac; *g.p.*, genital pore; *ov.*, ovary; *t.*, testes; *ut.*, uterus; *vag.*, vagina; *vit.*, zone occupied by the vitelline follicles.

nearer the dorsal surface of the medulla and are arranged as in fig. 10. In surface view the vesicles are seen to be slightly elongate with the long axis transverse to the segment. Their dorsoventral diameter is between .055 and .06 mm. while in surface view they measure about .03 to .05 mm. by .02 to .03 mm.

The *vas deferens* is a large and very much coiled tube situated just inwardly from the cirrus sac and overlying both the uterus and vagina.

The cirrus sac, a large irregularly rounded organ, lies laterally near the middle of the pore-bearing margin of the proglottis. It measures about .38 mm. in length and .28 mm. in maximum breadth. Within it lies the long, coiled

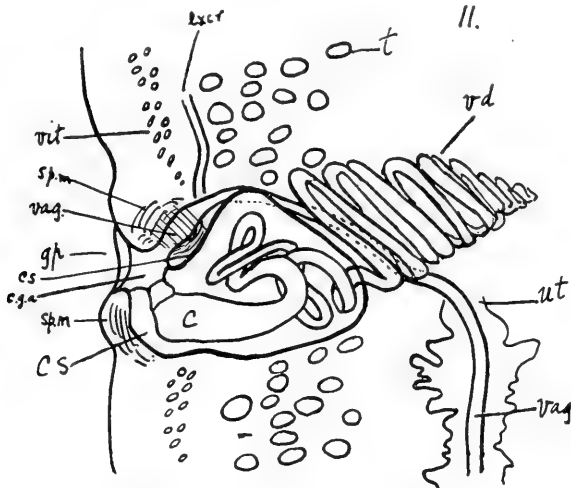


Fig. 11.—Portion of segment. *c.*, cirrus; *c.g.a.*, genital atrium; *c.s.*, cirrus sac; *excr.*, ventral excretory canal; *g.p.*, genital pore; *sp.m.*, sphincter muscle around genital atrium and outer portion of vagina; *v.d.*, vas deferens. Other lettering as in previous figures.

ejaculatory duct whose outer end is widened to constitute the cirrus. The latter when introverted has a length of about .25 mm. and a breadth of .07 mm. Spines were not observed on it. The organ does not appear to be very muscular.

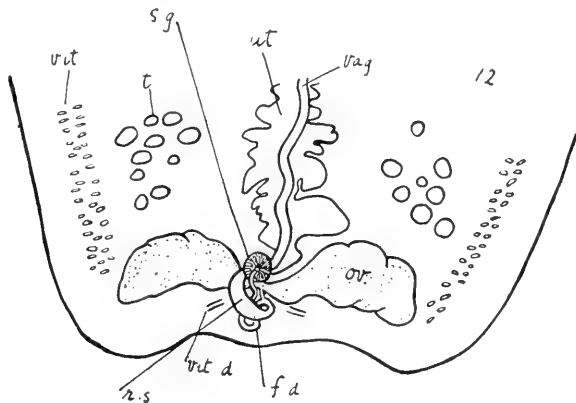


Fig. 12.—Showing details of female system, &c. *f.d.*, fertilising duct; *r.s.*, receptaculum seminis; *sg.*, shell-gland; *vit.d.*, vitelline duct. The short oviduct is also shown.

The male aperture opens into the genital atrium usually behind, but above the level of, the female pore. The terminal portion of the male apparatus is directed anterolaterally.

The atrium is surrounded by a well-marked sphincter, especially in the region of the female pore (fig. 14). There is only a slight genital papilla present at sexual maturity. It lies near the middle of the segment; and, as already mentioned, alternates irregularly.

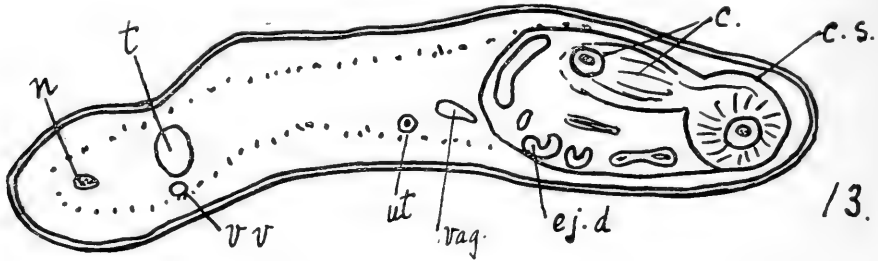


Fig. 13.—Transverse section of segment in region of cirrus sac (c.s.), showing ejaculatory duct (ej.d.) and cirrus (c.) cut across.

Female System.—The ovary is a fairly large, compact organ consisting of two pyriform lobes connected by a narrow ovarian bridge which lies more ventrally and rather more posteriorly than the rest of the gland. From the bridge there is given off a short, fairly wide oviduct provided with a “swallowing apparatus” (fig. 18).

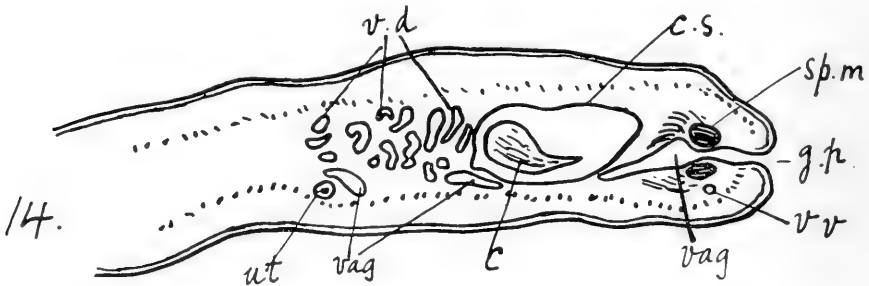


Fig. 14.—T.S., showing vagina opening into the genital atrium; also the sphincter muscle (sp.m.) surrounding the vagina; v.d., vas deferens. Other lettering as in preceding figures.

The vagina leads from the female pore which generally lies in front of, and ventrally to, the male aperture (fig. 11) but occasionally postero-ventrally. It is a rather wide tube which travels inwards ventrally or antero-ventrally to the cirrus sac very close to the ventral layer of longitudinal muscle and just above the excretory canal. It then curves backwardly behind and below the inner end of the cirrus sac, and below the coils of the *vas deferens*, becoming slightly narrowed as it passes inwards, its level gradually rising until it comes to be just above the uterus (figs. 13-15, 17). Its course is then practically

straight until it approaches the ovary when it becomes slightly sinuous and its lumen widened to constitute a *receptaculum seminis*. It passes between the ovarian bridge and the shell-gland. It forms a loop and is joined by the oviduct.

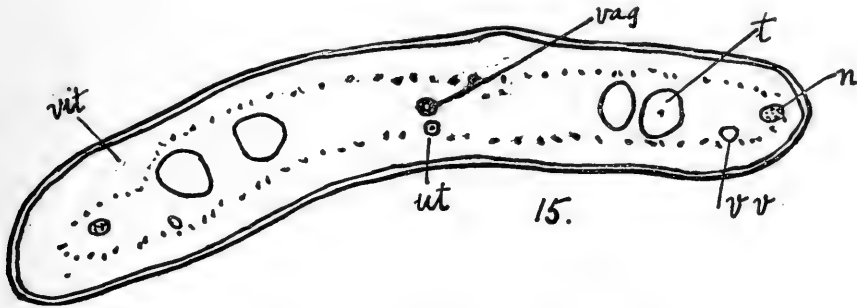


Fig. 15.—T.S. across posterior half of a segment.

The fertilising duct passes back below the vagina as a narrow tube and then travels forwards and upwards to penetrate the shell-gland. The point of entry of the vitelline ducts was not observed (figs. 16, 18).

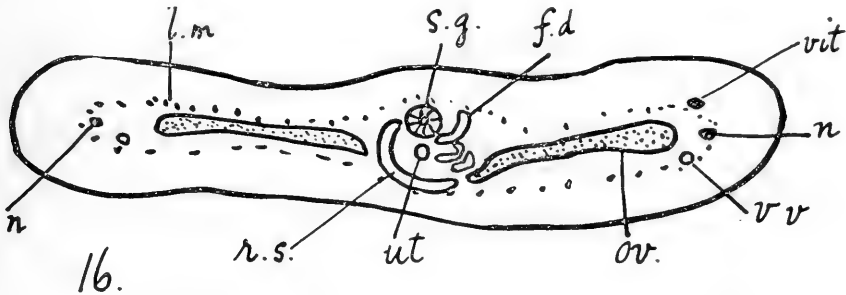


Fig. 16.—T.S. across female complex. Lettering as in preceding figures.

The uterus is at first a narrow canal but its walls soon become thrown into irregular sac-like folds. The organ lies in the ventral part of the medulla just above the ventral layer of longitudinal muscle, but below the vagina and *vas deferens*. It extends almost to the anterior end of the segment. Whilst immature the uterine walls are relatively thick when compared with the vagina (fig. 17). Uterine pores were not observed. Uteri with ripe eggs were found to be restricted to the inner zone of the proglottids.

The vitelline follicles are small, very numerous glands, occupying a restricted zone laterally to the testes, and extending along practically the whole length of the segment.

Ripe eggs possess apparently two shells and measure about .025 mm. in diameter, the oncosphere being about .012 mm. in diameter.

O. longmani is the first species of this genus to be described from an Australian reptile. Type specimens have been deposited in the collection of the Queensland National Museum.

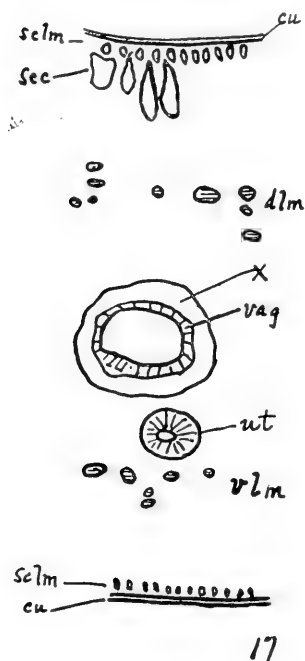


Fig. 17.—A more highly magnified view of the midregion of section figured in fig. 15. *s.c.c.*, subcuticular cells; *d.l.m.*, *v.l.m.*, dorsal and ventral longitudinal muscles; *x*, modified parenchyma surrounding vagina. Note the difference in thickness of the walls of the uterus and vagina.

Beddard's *Ophidotania* (1913a, p. 35; 1913c, p. 259) is a synonym of La Rue's *Ophiotania* (1913, 1914). Dr. Beddard lays stress upon the presence of uterine pores ventrally. La Rue (1913, p. 481), however, has mentioned that these may or may not be present in species of *Ophiotania*, and he has figured such openings in his *O. grandis* (1914, pl. 9, fig. 101).

If the possession of uterine pores be regarded as having generic importance then La Rue's genus might be divided, his name being retained for species in which the ventral outgrowths of the uterus do not reach the surface whilst forms like *O. grandis* would be transferred to Beddard's *Ophidotania*. It seems advisable to retain both groups of species under La Rue's *Ophiotania*.*

CENURUS SERIALIS, Gerv.

This larval parasite was taken by me in October, 1910, from a Coypu rat, *Myopotamus coypus*, which had died in the Sydney Zoological Gardens. The specimens were found in the musculature adjacent to the ribs. *C. serialis*, or better *Multiceps serialis*, has already been reported on a few occasions from this host (see Hall, 1910, p. 61) in America. It is not uncommonly met with in rabbits in Victoria (Sweet, 1909, p. 507) and New South Wales (Johnston, 1910, p. 343), where it sometimes occasions serious injury. In one instance, a rabbit was found by Dr. Cleland and myself, whose left eye had been completely destroyed by the development of a large cyst of this parasite in the connective tissue in the socket of the eye, the organ having become compressed and greatly flattened between the cyst and the orbit.

NEMATOTÆNIA, sp.

A few tiny cestodes collected by Dr. S. J. Johnston, of Sydney University, from New South Wales frogs, have been determined as belonging to this genus. They resemble *N. dispar* in general anatomy (Luhe, 1910, p. 124), but are quite small, the largest measuring 6 to 7 mm. in length and about .2 mm. in maximum width.

The species was taken from the duodenum of one specimen of *Hyla freycineti* and from the intestine of two *Hyperoleia marmorata*, while fragments

* Beddard (1913b, p. 157) has figured rudimentary uterine pores in *Ichthyotania gabonica* Bedd. (= *Ophiotania gabonica*) and (1913c, p. 255) in *Solenotania viperis* Bedd.

were collected from the rectum of *Hyla caerulea*. All these frogs were captured in the Sydney district, and a record of the finding of cestodes in them was made by Dr. S. J. Johnston (1912, pp. 290, 291).

A detailed account of this new species is reserved for a future communication, but as the genus is so far known only from a few amphibia from North America, and from the Mediterranean coasts and Central Europe, the record of its occurrence, though apparently rare, in Eastern Australia is important.

The only adult cestode so far described from Australian Amphibia is *Ophiotania hyla* Johnston (1912, p. 64), from the golden frog, *Hyla aurca*, from New South Wales.

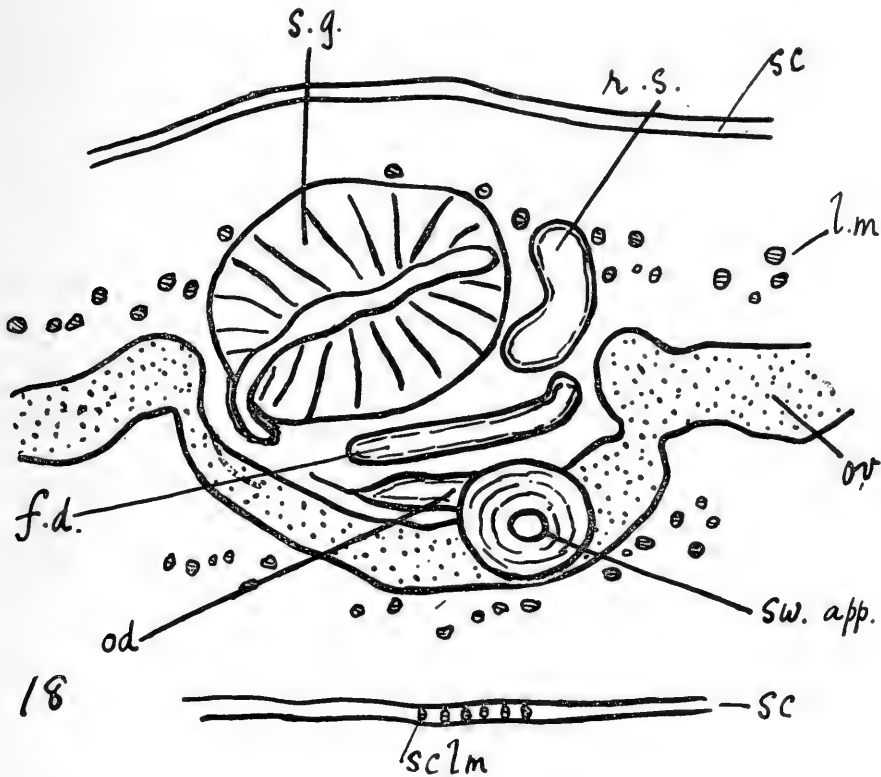


Fig. 18.—A more highly magnified view of a section across the female complex, showing swallowing apparatus (*sw. app.*), shell-gland (*s.g.*), receptaculum seminis (*r.s.*), ovary (*ov.*), and fertilising duct or perhaps uterine tube.

SPARGANUM, sp.

The Director of this Museum forwarded to me specimens of a larval cestode taken by Mr. H. A. Longman from the subcutaneous tissues of a frilled lizard, *Chlamydosaurus kingii*, caught near Brisbane. They belong to the same species as those recorded by me (Johnston, 1914, p. 110) from this lizard from North Queensland.

DENDROUTERINA, Fuhrmann.

This genus was erected by Fuhrmann (1912, p. 7) to receive a parasite, *D. herodiæ* Fuhrm., from an African heron, *Herodias garzetta*. A comparison of his figures and description with those of *Bancroftiella tenuis* Johnston (1911, p. 50), *B. glandularis* (Fuhrm.) (Johnston, 1913, p. 84), and *B. ardeæ* Johnston (1913, p. 85), leads one to the conclusion that *Dendrouterina* and *Bancroftiella* are congeneric. The former name becomes a synonym of the latter, and the parasite may be designated *B. herodiæ* (Fuhrm.).

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A COLLECTION OF BEES FROM QUEENSLAND.

By T. D. A. COCKERELL, University of Colorado.

THE object of the present paper is to report on a very interesting series of bees from Queensland, collected by Mr. H. Hacker, and kindly transmitted to me by Dr. R. Hamlyn-Harris. They are all represented by specimens in the Queensland Museum.

PROSOPIS Fabricius.

- | | | | | | | | | | |
|--|----|----|----|----|----|----|----|---|-----|
| Scutellum and postscutellum yellow | .. | .. | .. | .. | .. | .. | .. | .. | 1. |
| Scutellum and postscutellum dark | .. | .. | .. | .. | .. | .. | .. | .. | 6. |
| 1. Abdomen greenish blue (139, Bribie I., 2.11.13) | .. | .. | .. | .. | .. | .. | .. | <i>perplexa</i> Sm., ♀. | |
| Abdomen black | .. | .. | .. | .. | .. | .. | .. | .. | 2. |
| 2. Face-marks white or creamy white | .. | .. | .. | .. | .. | .. | .. | .. | 3. |
| Face-marks yellow | .. | .. | .. | .. | .. | .. | .. | .. | 4. |
| 3. Clypeus mainly white (130, Brisbane, 6.10.14) | .. | .. | .. | .. | .. | .. | .. | <i>aureomaculata</i> Ckll., ♂. | |
| Clypeus black with a small white mark (144, Sunnybank, Brisbane, 17.9.14) | .. | .. | .. | .. | .. | .. | .. | <i>aureomaculata</i> Ckll., ♀. | |
| 4. Face extremely narrow (146, Darra, 14.10.13) | .. | .. | .. | .. | .. | .. | .. | <i>aureomaculata</i> Ckll., ♂, variety. | |
| Face broad | .. | .. | .. | .. | .. | .. | .. | .. | 5. |
| 5. Mesothorax extremely finely punctured (142, Oxley, Brisbane, at <i>Leptospermum</i> , 8.9.14) | .. | .. | .. | .. | .. | .. | .. | <i>frederici</i> Ckll., ♀, variety with lateral face-marks short. | |
| Mesothorax coarsely punctured (143, Brisbane, 9.9.12) | .. | .. | .. | .. | .. | .. | .. | <i>obtusata</i> Sm., ♀. | |
| 6. Abdomen blue | .. | .. | .. | .. | .. | .. | .. | .. | 7. |
| Abdomen black | .. | .. | .. | .. | .. | .. | .. | .. | 10. |
| 7. Face below antennæ white or creamy white right across (135, 141, Brisbane, 17.2.14 and 6.10.14) | .. | .. | .. | .. | .. | .. | .. | <i>chromatica</i> Ckll., ♂. | |
| Face below antennæ not white right across | .. | .. | .. | .. | .. | .. | .. | .. | 8. |
| 8. Clypeus yellow, margined with black (128, Stradbroke I., 2.10.11) | .. | .. | .. | .. | .. | .. | .. | <i>disjuncta</i> Ckll., ♂. | |
| Clypeus black | .. | .. | .. | .. | .. | .. | .. | .. | 9. |
| 9. Tubercles marked with creamy white, not continuous with the white marks on prothoracic border (140, Sunnybank, Brisbane, 17.9.14) | .. | .. | .. | .. | .. | .. | .. | <i>disjuncta</i> Ckll., ♀. | |
| Tubercles bright yellow, the colour continuous with that on prothoracic border (134, Brisbane, 6.10.14) | .. | .. | .. | .. | .. | .. | .. | <i>chromatica</i> Ckll., ♀. | |
| 10. Greater part of femora yellow | .. | .. | .. | .. | .. | .. | .. | .. | 11. |
| Femora mainly or wholly dark | .. | .. | .. | .. | .. | .. | .. | .. | 12. |
| 11. Mandibles yellow (131, Brisbane, at <i>Leptospermum</i> , 12.9.12) | .. | .. | .. | .. | .. | .. | .. | (<i>Gnathoprosopis</i>) <i>euzantha</i> Ckll. | |
| Mandibles black (136, Brisbane, 6.10.14) | .. | .. | .. | .. | .. | .. | .. | (<i>Gnathoprosopis</i>) <i>amicula</i> Sm., ♂. | |
| 12. Tubercles white or very pale yellow | .. | .. | .. | .. | .. | .. | .. | .. | 13. |
| Tubercles bright yellow | .. | .. | .. | .. | .. | .. | .. | .. | 14. |
| 13. Face below antennæ very pale yellow right across (129, Oxley, Brisbane, 17.9.14) | .. | .. | .. | .. | .. | .. | .. | <i>perhumilis</i> Ckll., ♂. | |
| Clypeus black, lateral face-marks white (145, Brisbane, 13.10.14) | .. | .. | .. | .. | .. | .. | .. | <i>eburniella</i> Ckll., ♀. | |
| 14. Yellow band on prothorax interrupted (137, 138, Brisbane, at <i>Leptospermum</i> , 6.10.14) | .. | .. | .. | .. | .. | .. | .. | (<i>Gnathoprosopis</i>) <i>hackeri</i> Ckll., ♂ and ♀. | |
| Yellow on prothorax continuous | .. | .. | .. | .. | .. | .. | .. | .. | 15. |
| 15. Face all black (151, Caloundra) | .. | .. | .. | .. | .. | .. | .. | <i>melanops</i> Ckll., n. sp. | |
| Face with yellow lateral marks (132, 133, Brisbane, 6.10.14) | .. | .. | .. | .. | .. | .. | .. | <i>amicula</i> Sm., ♀. | |

- | | | | | |
|--|----|----|----|-----------------------|
| 1. Postscutellum with white tomentum ; wings not brown | .. | .. | .. | <i>kelvini</i> Ckll. |
| Postscutellum without tomentum ; wings brown | .. | .. | .. | <i>melanops</i> Ckll. |

PACHYPROSOPIS Perkins.**Pachyprosopis hackeri** n.sp.

♀. Length a little over 5 mm. ; robust, black, moderately shining ; labrum, mandibles (except apex), anterior tibiae, and all the tarsi ferruginous ; head broad and thick, subquadrate, extremely feebly and minutely punctured ; the broad front is dullish, and very faintly greenish ; flagellum very short, dull ferruginous beneath ; mesothorax and scutellum like the front ; base of metathorax smooth and shining ; tegulae black ; wings hyaline ; stigma large, piceous, veins brown, second submarginal cell with the shape typical of the genus ; abdomen broad, without distinct punctures.

Hab. : Oxley, Brisbane, Sept. 24, 1914 (*Hacker* 150). Related to *P. angophoræ* Ckll., but in that species, in addition to the colour differences, the mesothorax is very much more closely and distinctly punctured. *P. atromicans* Ckll. is much smaller, and has the first recurrent nervure meeting the first transversocubital, whereas in *P. hackeri* the first recurrent joins the first submarginal cell as far from its apex as the second recurrent from the apex of the second submarginal.

EURYGLOSSA Smith.

- | | | | | |
|--|----|----|----|--------------------------|
| Thorax yellow, marked with black (159, Brisbane, 6.10.14) | .. | .. | .. | <i>flavopicta</i> Smith. |
| Thorax black | .. | .. | .. | 1. |
| 1. Abdominal segments with marginal pale tegumentary bands (156, 162, Oxley, Brisbane, Sept. 1914 ; Sunnybank, Brisbane, 3.10.12, at flowers of <i>Jacksonia scoparia</i> R.Br.) | .. | .. | .. | <i>chrysoceras</i> Ckll. |
| Abdomen without such bands | .. | .. | .. | 2. |
| 2. Abdomen red (161, Oxley, Brisbane, 24.9.14) | .. | .. | .. | <i>edwardsii</i> Ckll. |
| Abdomen black (168, Oxley, Brisbane, 17.9.14) | .. | .. | .. | <i>neglectula</i> Ckll. |

Euryglossa flavopicta Smith.

The specimen (♀) possibly represents a variety, but Smith's description is rather too short. The mandibles are yellow, broadly rufous apically ; lateral black stripes running down orbital margins some distance from the transverse band on vertex, of which they are the continuation ; black bands going downwards from lateral ocelli very broad, but not reaching antennal sockets ; scutellum with two dark spots, but no band, though there is a black band in suture between scutellum and postscutellum ; area of metathorax black, except a very large median yellow patch, which divides the black (except along extreme base) into two triangular areas ; abdomen with four broad dark bands, and a narrow transverse discal band on first segment ; fifth and sixth segments yellowish brown, not banded. The nearest relative is *E. chrysocera* Ckll., from Townsville.

Euryglossa edwardsii Cockerell.

This seems to be essentially identical with one of the forms (β) of *E. variabilis* Perkins, a species described six years later than *edwardsii*. The posterior corners of the abdominal tergites (overlapping the venter) are broadly colourless.

Euryglossa neglectula Cockerell.

Described from a specimen labelled "Australia" ; a precise locality was not known until the species was rediscovered by Mr. Hacker.

PARACOLLETES Smith.

Paracolletes ornatissimus n. sp.

♀. Length about 8.5 mm.; head and thorax yellow-green, bluish green on pleura and metathorax; clypeus and supra-clypeal area black (more or less edged with rosy), very smooth and shining, the clypeus with strong well-separated punctures; mandibles black, faintly reddish subapically; flagellum obscure brown beneath, becoming clear red at apex; face and cheeks with dull white hair, vertex with fuscous; mesothorax closely but shallowly punctured, dull and granular, the posterior disc shining; area of metathorax with delicate raised lines; hair of thorax above pale ferruginous; tegulae piceous; wings clear, stigma lanceolate, amber colour; legs black, with the hind tibiae and all the tarsi red; scopa of hind tibiae large, dark fuscous on outer side, otherwise white; abdomen shining but not polished, not evidently punctured, bright peacock green shading posteriorly into brilliant lilac-purple, the first segment crimson shading posteriorly into purple; caudal fimbria black; venter with long pure white hair.

♂. Head and thorax dark blue-green, suffused with yellowish green on the front; flagellum long, entirely dark; abdomen peacock-green, the first segment crimson, shading through purple into green posteriorly; all the knees, tibiae and tarsi, and hind femora except at base, chestnut-red; hair of head and thorax above strongly suffused with blackish.

Hab.: Oxley, Brisbane, Sept. 24, 1914 (*Hacker*). The female is the type. Close to *P. semipurpureus* (Ckll.), of which it may be a brilliantly coloured race, but I have seen *semipurpureus* from various localities, and never such a form as that now described. The male resembles *P. plumosellus* Ckll., but differs by the black tegulae. From *P. plumosus* Sm. the new form is easily known by the much smaller size. *P. bicolor* Sm. is the male of *plumosus*, as Mr. Meade-Waldo has determined. *P. amabilis* Sm. is also allied. Australian students may determine by field studies that *P. ornatissimus* is not entitled to specific rank, but such a beautiful form deserves a name, which can then be used in a varietal or subspecific sense. The species bears *Hacker's* number 147.

NOMIA Latreille.

Nomia gracilipes Smith.

A female from Darra, Brisbane, 10.3.14 (153). The last three abdominal segments are chestnut-red, much brighter than I have previously seen in this species; the first three segments are blue.

PARASPHECODES Smith.

Thorax clear ferruginous	..	..	..	..	..	..	..	..	..	<i>aurantiacus</i> Ckll.
Thorax black	..	..	..	..	..	..	..	..	..	.. 1.
1. Abdomen brown	..	..	..	..	..	..	..	..	..	<i>bribiensis</i> Ckll.
Abdomen wholly or partly chestnut-red	..	..	..	..	..	..	..	..	..	.. 2.
2. Abdomen entirely red	..	..	..	..	..	..	..	..	..	<i>speculiferus</i> Ckll.
Abdomen with only the first three segments red	..	..	..	..	..	..	..	..	..	<i>leptospermi</i> Ckll.

Parasphecodes aurantiacus n. sp.

♀. Length 8 mm.; head black, with the lower half of clypeus obscure testaceous, labrum ferruginous, mandibles ferruginous with the bidentate apex black; clypeus shining, with sparse large punctures; front dull and granular, shining at extreme sides; scape fulvous, flagellum dark brown, redder beneath; hair of head short and scanty, pale; thorax, tegulae, and legs entirely bright orange-fulvous,

without markings, the thorax with scanty pale yellowish hair; mesothorax very minutely and indistinctly punctured; area of metathorax with a median triangular dull area; scutellum bigibbous, much lighter and yellower than mesothorax; wings dusky hyaline, darker at apex; second submarginal cell large; first recurrent nervure meeting second transversocubital; hind tibiae and tarsi with stiff golden hair, blackish on upper (posterior) side of tibiae; hind femora with a large curled scopa of very pale yellowish hair; abdomen shining, very finely and obscurely punctured, the first three segments clear orange-fulvous, the others black, with dark hair.

Hab.: Brisbane, May 28, 1914 (*Hacker* 160). A very distinct and peculiar species, allied to *P. contaminatus* Ckll. from Cairns, but readily known by the entirely orange-fulvous thorax.

***Parasphecodes bribiensis* n. sp.**

♀. Length 8 mm. or a little more; rather long and narrow; head and thorax black, abdomen dark reddish brown, the apical two segments suffused with black; legs piceous, the anterior tibiae with a clear ferruginous patch on inner side (about basal two-thirds), beset with long reddish hair; hair of head and thorax dull white, scanty; head broad; mandibles with apical half red; clypeus polished, sparsely and weakly punctured; antennae entirely dark; tubercles prominent; mesothorax and scutellum densely and finely granular-punctate; area of metathorax finely granular, with weak irregular wrinkles; sides of metathorax pruinose with fine greyish white tomentum; posterior truncation small, depressed in middle; tegulae pale rufo-testaceous; wings strongly reddened, stigma and nervures dull red; second submarginal cell broad; first recurrent nervure meeting second transversocubital; outer recurrent and transversocubital weakened; hind femora slender, with a curled scopa; hair on upper side of hind tibiae fuscous; abdomen shining, without evident punctures, first two segments each with a transversely oval polished swelling in each sublateral area; no hair-bands or patches.

Hab.: Bribe Island, Nov. 2, 1913 (*Hacker* 91). A peculiar species, known from other *Parasphecodes* by the brown abdomen, with oval bosses on the first two segments. It could be regarded as a species of *Halictus*, and would then fall as follows in a table of species having the mesothorax black, and the abdomen red or brown, or largely so:—

Male; abdomen lively ferruginous, with apex broadly black	..	..	..	<i>H. disclusus</i> Ckll.
Females	..	..	..	1.
1. Scutellum and postscutellum densely covered with ochreous tomentum	..	..	..	2.
Scutellum and postscutellum not thus covered	..	..	..	3.
2. Second abdominal segment with a broad black band	..	..	..	<i>H. doddi</i> Ckll.
Second abdominal segment with no such band	..	..	..	<i>P. bryotrichus sordidulus</i> Ckll.
3. Smaller, wings clear	..	..	..	<i>H. cyclurus</i> Ckll.
Larger, wings smoky	..	..	..	<i>P. bribiensis</i> Ckll.

***Parasphecodes speculiferus* Cockerell.**

♀. Length 7 mm.; robust, with short broad abdomen; head, thorax, and legs black. Abdomen entirely chestnut-red, with a vague purplish tint; hair of head and thorax greyish white, stained with blackish dorsally; head broad; mandibles reddened only at extreme apex; clypeus shining, with strong sparse punctures; antennae black, the flagellum (except basally) very obscurely brownish beneath; front extremely densely and minutely punctured; mesothorax dull, densely and

minutely rugosopunctate, gibbous in front; scutellum a little more shining, with a median depression; area of metathorax with rather weak plicæ, failing distally; tegulæ brown with pallid margins; wings hyaline, slightly dusky, the apex darker; stigma and nervures dusky reddish brown; second submarginal cell rather small, third very large; first recurrent nervure meeting second transversocubital; outer recurrent and transversocubital weakened; hair of legs fuscous on outer side, pale on inner, the middle tibiæ with a stiff pale orange brush near apex; abdomen with the first segment and basal half of second very distinctly though very minutely punctured, the parts beyond with only scattered piliferous punctures; no hair-bands or patches; apex with fuscous hair; venter with shining white hair.

Hab.: Oxley, Brisbane, at *Leptospermum*, Sept. 8, 1914 (*Hacker* 148). *P. speculiferus* was described in 1912 from Victoria; I give a new description from the Brisbane specimen. The species is somewhat variable.

Parasphecodes leptospermi n. sp.

♀. Length about 9.5 mm., expanse fully 17; robust; head, thorax, and legs black; abdomen with the first two segments bright chestnut-red, the third more dusky, but still red, the others black; head broad; mandibles black; clypeus brilliantly shining, with scattered punctures; front rough but glistening; antennæ dark, the flagellum reddened at tip; hair of head and thorax dull white, much blackened dorsally; mesothorax finely and extremely densely punctured; scutellum bigibbous, the elevations shining though punctured; area of metathorax with weak irregular rugæ; tegulæ rufopiceous, with the anterior margin pallid; wings dusky hyaline, darker apically; first recurrent nervure joining apical corner of the large second submarginal cell; middle femora with a brush of red hair beneath at base; abdomen with first segment, and second except apical depression, finely and distinctly punctured.

Hab.: Oxley, Brisbane, at *Leptospermum*, Sept. 8, 1914 (*Hacker* 149). Allied to *P. speculiferus*, but easily known by its large size and black apical segments of abdomen. It appears to be closest to *P. hybodinus* Ckll., described from a male collected in Victoria, but on comparing specimens I do not think they are the sexes of the same species. There is also some resemblance to *P. tilachus* Smith.

HALICTUS Latreille.

Mesothorax green	..	..	..	..	..	..	..	..	..	..	1.
Mesothorax black	..	..	..	..	..	..	..	..	..	..	3.
1. Abdomen red, marked with black (163, Brisbane, Sept. 1914)	..	..	..	..	..	..	..	..	..	<i>punctatus</i> Smith.	
Abdomen not at all red	..	..	..	..	..	..	..	..	..	..	2.
2. Abdomen green (164, 169, Brisbane, 1.9.14; Oxley, Brisbane, Sept. 1914)	..	..	..	..	..	..	..	..	..	<i>dampieri</i> Ckll.	
Abdomen black or piceous (155, 170, Brisbane, 13.4.15, and on cockscomb in garden, 10.4.15)	..	..	..	..	..	..	..	..	..	<i>urbanus</i> Smith.	
3. Females	..	..	..	..	..	..	..	..	..	<i>semipolitus</i> Ckll., n. sp.	
Males	..	..	..	..	..	..	..	..	..	..	4.
4. Tegulæ rufous	..	..	..	..	..	..	..	..	..	<i>reptulus</i> Ckll., n. sp.	
Tegulæ black	..	..	..	..	..	..	..	..	..	<i>bursariæ</i> Ckll., n. sp.	

Halictus semipolitus n. sp.

♀. Length about 5.5 mm., anterior wing scarcely over 4; black, including legs, with scanty greyish white hair, not forming patches or bands on abdomen; mandibles with a dark red subapical band; flagellum obscure red apically; tegulæ dark reddish; wings strongly smoky, stigma dark brown, nervures sepia; anterior

knees red; front dull, shining at extreme sides; mesothorax shining, especially posteriorly, the scattered punctures extremely minute and hardly visible; area of metathorax dull, covered with fine wrinkles; venter of abdomen with long white hair, in which pollen is collected.

Microscopical characters: Front as densely punctured as possible; mesothorax minutely tessellate, with scattered piliferous punctures; area of metathorax irregularly reticulate; first abdominal segment finely punctate; second with basal third punctate, the rest transversely striate; hind spur with few long teeth.

Hab.: Bribie Island, type taken 2.11.13 (*Hacker* 117). Another, with same data, bears number 167. Close to *H. Blackburni* Ckll., but mesothorax and metathorax different. The area of metathorax is entirely different from that of *H. sturti* Ckll. Among the Tasmanian species it falls near the much larger *H. furneauxi* Ckll.

Halictus bursariæ n. sp.

♂. Length 6 mm. or slightly over; rather robust, shining black, with scanty dull white hair, which forms small inconspicuous patches at lateral bases of second and third abdominal segments; mandibles black, very obscurely reddish subapically; clypeus shining, with well-separated punctures, and an obscure yellowish transverse band; face with thin white hair; front dull; antennæ long, entirely dark, the flagellum crenulated beneath; mesothorax shining, polished, distinctly though not densely punctured; scutellum with the two shining slight elevations almost impunctate; area of metathorax minutely wrinkled, the margin shining; tegulæ black; wings hyaline, faintly dusky, stigma dusky reddish, nervures sepia; first recurrent nervure joining apical corner of second submarginal cell; legs black, the small joints of tarsi ferruginous, and the middle and hind basitarsi obscure reddish; abdomen very finely punctured, hind margins of segments not discoloured; apical segments with rather long pale hair; a broad red apical plate; fourth ventral segment heavily fringed with white hair, the margin of the fringe emarginate.

Microscopical characters: Front extremely closely punctured, the punctures subconfluent; mesothorax well punctured, on a smooth (not tessellate) surface; area of metathorax with labyrinthiform wrinkles; second abdominal segment with piliferous punctures.

Hab.: Brisbane, Jan. 10, 1913, at flowers of *Bursaria spinosa*, Kelvin Grove (*Hacker* 93).

In a table of more or less similar males, this is separated as follows:—

Tibiæ red, more or less suffused with dusky (Tasmania)	..	..	..	<i>isthmalis</i> Ckll.
Tibiæ dark	..	..	..	.. l.
1. Mesothorax shining	..	..	..	<i>bursariæ</i> Ckll.
Mesothorax dull	..	..	..	<i>idoneus</i> Ckll.

H. bursariæ is a member of the group which includes *H. cambagei*, *H. repertus*, *H. isthmalis*, and *H. repertulus*.

Halictus repertulus n. sp.

♂. Length about 5.5 mm.; black, moderately robust, with scanty greyish white hair, not forming distinct bands or spots on the abdomen, though there are small and thin, hardly noticeable, patches at lateral bases of second segment; mandibles with a small cream-coloured spot in the middle, and the apical part red; clypeus shining, minutely and feebly punctured, nearly the apical half very pale yellow; face with short white hair; front dull; flagellum only moderately long, very obscure

reddish beneath ; mesothorax shining, finely and rather closely punctured ; area of metathorax very short, very minutely plicate ; posterior truncation with a conspicuous median pit ; tegulæ bright ferruginous ; wings dusky hyaline, stigma and nervures reddish sepia ; second submarginal cell broad ; legs black, with the knees, anterior tibiæ (except a large black patch behind), apices of middle and hind tibiæ, and all the tarsi, clear ferruginous ; hind tibiæ and tarsi with much white hair ; abdomen shining, extremely finely punctured, hind margins of segments not discoloured ; apical plate broad and rounded, red ; venter with white hair.

Microscopical characters : Front densely striato-punctate ; mesothorax well punctured on a smooth (not tessellate) ground ; area of metathorax with vermiform rugæ ; second abdominal segment well punctured all over.

Hab. : Sunnybank, Brisbane, Nov. 19, 1913 (*Hacker* 165). Allied to *H. cambagei* Ckll., but the head is not so broad, the mesothorax is more regularly and distinctly punctured, and the area of metathorax is different. It is smaller than *H. repertus* Ckll., with smaller punctures of mesothorax, and shorter and more finely sculptured area of metathorax.

MEGACHILE Latreille.

Megachile cetera Cockerell.

Brisbane, March 30, 1913 (*Hacker* 152). The female is easily distinguished from *M. quinquelineata* Ckll. by the absence of black hair on hind tarsi.

ALLODAPE Lepeletier.

Allodape bribiensis Cockerell.

Bribie Island, Nov. 2, 1913 (*Hacker* 166). A very small species.

EXONEURA Smith.

Abdomen black	..	..	..	..	..	..	..	..	..	<i>botanica</i> var. <i>aterima</i> Ckll., n.v.
Abdomen red	..	..	..	..	..	..	..	..	..	1.
1. Face with a large pale yellow mark	..	..	..	..	..	..	..	..	..	<i>tau</i> Ckll.
Face all black	..	..	..	..	..	..	..	..	..	<i>brisbanensis</i> Ckll., n. sp.

Exoneura botanica Ckll., var. *aterima* n. var.

♀. Larger than the type (length fully 5 mm.) ; abdomen all black, the hind margin of segments not reddened. Considerably smaller than *E. insularis* Ckll., with the tubercles creamy white and the wings not reddened.

Hab. : Brisbane, Sept. 1, 1914 (*Hacker* 157).

Exoneura tau Cockerell.

♀. Oxley, Brisbane, Sept. 17, 1914 (*Hacker* 154). The basal segments of the abdomen are red, wholly without black markings.

Exoneura brisbanensis n. sp.

♀. Length about 5 mm. ; head and thorax shining black, abdomen rather dark chestnut-red, the basal segment and a broad transverse band on second blackened ; face broad (but orbits distinctly converging below), shining, wholly without markings ; mandibles black ; flagellum thick, clear red beneath, more dusky toward base ; tegulæ piceous ; wings reddish hyaline, stigma and nervures ferruginous ; legs black, with the anterior and middle tarsi obscure red ; hind tibiæ and tarsi with coarse black hair on outer side ; tubercles margined with creamy white.

Hab. : Brisbane, Sept. 1, 1914 (*Hacker* 158). Related to *E. froggattii* Friese and *E. concinnula* Ckll., but easily known by the black tibiæ.

AUSTRALIAN HYMENOPTERA CHALCIDOIDEA.

GENERAL SUPPLEMENT.

BY A. A. GIRAULT.

HEREIN are recorded the examinations of some of the types of Howard and of Ashmead which are in the United States National Museum; errors of omission and commission; and the addition of new genera and species. This supplement I consider of some importance since in it I am able to make quite a number of new observations and to throw light upon a number of old genera, heretofore very poorly (inexcusably so, it seems to me) described. The index and bibliography are deferred for the present as is also a second general supplement, covering the remainder of the families.

FAMILY TRICHOGRAMMATIDÆ.

ABELLA XANTHOGASTER Girault.

A female, window, Muswellbrook, New South Wales, October 25, 1914.

ABELLA SUBFLAVA SUBFLAVELLA new variety.

The Australian variety differs from the North American one in minor arrangements of the discal ciliation of the fore wing and it seems native to Australia. All former references here to *subflava* mean this variety. Types compared.

A female from a window, Muswellbrook, New South Wales, October 25, 1914.

Type: No. Hy 3549, Queensland Museum, Brisbane, the above specimen on a slide.

UFENS LUNA Girault.

“*Ufens luna*, sp. n. (normal position). ”

Female.—Length 0.60 mm. Exactly similar in general structure, appearance, and colour to the type species—*niger* (Ashmead)—but differing as follows: In the fore wings primarily: they have distinctly shorter marginal cilia, short in the type species, but here very short and close, hardly distinguishable from the edges of the wing; the discal ciliation is different, not so dense, the straight, distinct lines more numerous, consequently not peculiarly distinct as in *niger*; also the fore wing is fumated farther distad, and more distinctly, though not pronouncedly. In the legs: the posterior femora are more enlarged, ovate, and with a longitudinal lamellate sculpture. The posterior wings differ in being less

pointed at tip, there the caudal margin bevelled off, curving convexly up to the tip of the straight cephalic margin; at this curve the marginal cilia abruptly shorten, otherwise as in the type species, to which evidently it is closely allied. (From one specimen, $\frac{2}{3}$ -inch objective, 1-inch optic, Bausch and Lomb.)

Male.—Unknown.

Described from a single female specimen received from Dr. L. O. Howard, mounted in balsam, and labelled: '923. Perth, W. Austr. G. Compere.'

Habitat.—West Australia (Perth).

Type.—Type No. 13,794, United States National Museum, Washington, D.C.; a single female in balsam."

The abdomen is conic-ovate. The legs are black, not as described in the table of species *in antea*.

OLIGOSITA MINIMA Girault.

In the original description, page 77, lines 15 and 18, 65 read 78.

PSEUDOGRAMMA Girault.

In the original description, page 88, line 5 of the description, the *hyphen* should follow the word *ring*.

PAROLIGOSITA Girault.

For this genus I propose the new name *Epoligosita*. *Paroligosita* Kurjumov is identical with *Oligosita* Haliday.

TRICHOGRAMMA MINUTUM Riley.

A female on a slide in the U.S. National Museum, labelled "G. Compere, No. 885. Par. on noctuid eggs on Acacia. Swan River, West Australia."

OLIGOSITA BREVICILIA Girault.

The "three pairs of transverse marginal spots" of the original description means three spots on each side, a *total* of *six* spots.

GENUS PTERYGOGRAMMA Perkins.

"PTERYGOGRAMMA gen nov.

Head strongly transverse, ocelli in a triangle with very wide base, the posterior ones touching the eye-margins. Antennae apparently six-jointed, counting an extremely short ring-joint, the three terminal joints apparently form a widely dilated but pointed club, the terminal joint in some aspects almost spinose in appearance; pedicel widely ovate, the scape also apparently somewhat dilated. Owing to the thinly laminate character of the joints, the antennae are subject to much distortion. Scutellum rather less long than the mesonotum; the metanotum pointed posteriorly and produced over the base of abdomen; the latter elongate and acuminate, twice as long as the thorax, and apparently laterally compressed somewhat like some *Mymaridae*; the ovipositor exerted for a length nearly equal to the hind tarsi. Wings with the lines of hairs rather confused, and about 7 or 8 in number, the apical fringe not very long.

Plate XX, fig. 7.

PTERYGOGRAMMA ACUMINATA, sp. nov.

Head and mesonotum ferruginous, or brownish, the latter with a pair of fuscous marks in front; scutellum, and rest of thorax above, pale yellow; abdomen black. Wings more or less fuscous on the basal half, the dark colour tending to form three dark areas. Tarsi and the tibiae more or less pale yellow, the femora for the most part blackish or infusate, the middle and posterior pair pale at base and apex. Length $\frac{3}{4}$ mm. The specimens were badly preserved and mounted in balsam.

Hab: Bundaberg, Queensland; bred from eggs of Jassid embedded in twigs of *Eucalyptus*. Koebele's number 2298."

PARUSCANOIDEA AUSTRALIA new species. Female.

Length, 0.60 mm. Black, the tarsi and tips of tibiae pale, the margins of the scutellum yellowish, the fore wings distinctly but not very deeply clouded for their entirety, without discal cilia except a faint line of about seven minute cilia running from apex of the stigmal vein to apex of the blade and a pair of these in a line longitudinally (i.e., two cilia), one pair cephalad of the apical end of the long line, one disto-caudad of its end. Marginal cilia of fore wing moderately short, not a sixth of the greatest wing width, about as in *Trichogrammatoidea*. Marginal vein linear, over thrice the length of the stigmal. Caudal wings narrow, their longest marginal cilia distinctly longer than the cilia of the fore wing, bearing a distinct, median, complete line of discal cilia and no other. Abdomen as in *Pterygogramma*. Caudal femora swollen, coarsely scaly. Club obliquely divided, its first joint wider at apex than long, its second one about twice the length of the first, conic-ovate. Ring-joint distinct, minute. Pedicel subquadrate. Scape short. Stigmal vein ovate, its neck short, narrow. Ovipositor not extruded.

Described from one female on a slide in the U.S.N.M. labelled "2029. *Aspidiotus* on *Eucalyptus*. Botany Bay, Sydney, New South Wales, December 21, 1899. Hem. eggs present. Koebele" and with a *Perissopterus*.

Type: Catalogue No. 19675, U.S.N.M., the foredescribed specimen.

In III, page 148, line 12 from bottom, insert *parentheses* about the word *Girault*; page 150, in the first line under *Lathromella* insert after *female* the words of the *genotype*; page 150, line 3, *Ratzburg* should be *Ratzeburg*.

FAMILY MYMARIDÆ.

In I, p. 129, line 13, the third word should be capitalized.

In III, p. 154, sentence 1 under *Camptoptera gregi* is mistaken; page 156, line 9 from bottom, place *parentheses* about the word *Perkins*; page 168, footnote, V should read III and XV should be XIV; page 169, line 9, omit the *comma* after *globosicornis*. *Camptoptera gregi* has a "ring-joint" between joints 1 and 2 of the funicle (female).

LEIMACIS AUSTRALIA new species.

Female:—Length, 0.40 mm. Small for the family.

Black, very finely sculptured. Proximal two thirds of abdomen golden yellow; legs, scape, and pedicel dull yellow; coxæ dusky proximad. Wings practically hyaline.

Funicle 1 a little longer than wide, shorter than the pedicel, 2 longest, over thrice the length of 1, somewhat longer than 3 and narrower; funicle 3 subequal to 4, 5 or 6; club a little longer than funicle 2 but stouter. Strigil present, delicate. Joint 1 of cephalic tarsus distinctly much longer than any of the following joints, nearly twice the length of the same joint in the other tarsi. Caudal tibial spur single. Mesopostscutellum as long as the scutellum, both much wider than long. Fore wing about as in *Anagrus*, the discal ciliation arranged in about three lines, the cephalic and caudal of the three disappearing distad; also a line of cilia around the margins and disto-cephalad a short line near this marginal line. Marginal cilia of fore wing somewhat longer than the greatest width of the blade, longest disto-caudad. Apex of venation distad of the middle point of the wing, apparently clavate but this is due to the short curved stigmal vein which is nearly parallel with the margin and obscurely differentiated. Venation with about a half dozen very long, black bristles. Propodeum plane mesad.

Described from one female taken from a kitchen window, Brooklyn, New South Wales, November 10, 1914. Doubtless a forest insect.

Habitat: Brooklyn, New South Wales.

Type: No. Hy 3550, Queensland Museum, Brisbane, the above specimen on a slide.

A paratype female had the extreme apex of its abdomen black, and then a rather broad cross-stripe of black before this: these probably suffuse in most specimens. A paratype female in the U.S.N.M., Catalogue No. 19141, slide.

EOMYMAR CAMPTOPTEROIDES new species.

Female:—Length, 0.60 mm.

Jet black. With the habitus and structure of *Camptoptera* but the male antennæ 11-jointed, the female antenna with a small yet distinct, subquadrate tenth joint (funicle 2, larger than the ring-like funicle 2 of the named genus). Legs (except coxæ and base of the femora), scape and pedicel, orange yellow; rest of antenna dusky black. Wings lightly infuscated throughout, the fore wings with a dark yellow border, the caudal wings with a row of round, hyaline dots along the caudal margin. Tarsi dusky except the proximal joint of the cephalic legs. Caudal wings with a double row of minute setæ along its caudal margin. Fore wings with a double row of discal cilia along each margin and a midlongitudinal line which is composed of longer setæ and extends from near apex to about middle.

Strigil present. Wings as in *Camptoptera*. Propodeum declivous. Pedicel a little longer than wide, shorter than funicle 1 which is subequal to 3 and about four times longer than wide; funicle 2 abruptly very short, very slightly longer than wide; funicle 4 widening a little distad, 5-7, wider, 7 short, cylindrical ovate, slightly shorter than 5 or 6, the latter about twice longer than wide.

The male is about the same but the antennæ are filiform, the pedicel subglobular, the funicle joints all elongate and with a minute ring-joint between all of them and each about six times longer than wide, not excepting the club.

Described from a single pair on a slide and captured on windows, October 26, 1914 (A. P. Dodd).

Habitat: Gordonvale (Cairns), Queensland.

Types: No. Hy 3551, Queensland Museum, Brisbane, the foregoing specimens.

Mr. A. P. Dodd made the following notes before sending the specimens: Head transverse (dorsal aspect); antennae inserted wide apart, well below the middle of the face. Thorax a little longer than wide; scutum with dense scaly reticulation, the parapsidal furrows wide apart; scutellum nearly smooth, separated from the scutum by a transverse sclerite; scutellum large. Abdomen short and stout, with a short petiole, the second segment rising abruptly from it, this segment occupying nearly half the surface, its caudal margin convex.

EOMYMAR MAXIMUS new species.

Female:—Length, 0.60 mm. Thorax without a phragma (with one in *Dicopus psyche*).

Differs markedly from *psyche* in its greater size; funicles 2-4 are not subequal but 3 is longest while 2 is subequal to 4; funicle 1 is only two thirds the length of the pedicel; the proximal half of the fore wing is distinctly infuscated, the rest hyaline; the disto-cephalic edge of the fore wing is broadly enbrowned. Scape and pedicel pallid; transverse scutellum orange yellow. Funicle 3 not quite twice the length of 1 which is two thirds longer than wide. The fore wings are very much broader. Fore wings with a paired row of setae along each margin and midlongitudinally with about eight setae in a line but somewhat irregular (and equally distant from apex of blade and apex of the venation). Marginal cilia of the fore wing very long. The scutellum is preceded by a rather broad, transverse sclerite and itself is much wider than long and divided along the meson, there longest.

Described from two females taken from a window, Brooklyn (Hawkesbury River), New South Wales, November 2, 1914.

Habitat: Brooklyn, New South Wales.

Types: No. Hy 3552, Queensland Museum, Brisbane, the above specimens on a slide.

ALAPTUS IMMATURUS Perkins.

“*Alaptus*, Hal.

Antennae of female 8-jointed, the scape elongate, the second joint dilated and much wider than the following, third slender, elongate, rather shorter than the fourth, fifth, sixth, and seventh, increasing in width, club nearly as long as the four preceding. Antennae of male 10-jointed, the scape elongate, second wider than the following, third elongate, but shorter than the fourth, which is subequal to the following joints. Posterior ocelli close to the eye-margins, the three following forming a triangle with extremely wide base. Tarsi 5-jointed. Abdomen sessile. (Plate XII, fig. 5; antennae of female in two aspects and that of the male.)

Alaptus immaturus, sp. nov.

Female: Pallid ochreous, the head sordid and also the thorax along its posterior margin; abdominal segments with obscure sub-quadrated, lateral, blackish or sordid spots. Antennae with two basal joints pale, the rest dark. Length $\frac{3}{4}$ mm.

Hab: Bundaberg, Queensland, bred from cane leaves containing leaf-hopper eggs, but I do not feel sure that it is parasitic on these.”

Type: Query.

GENUS *PARANAGRUS* Perkins.

“ *Paranagrus*, gen. nov.

Like *Anagrus*, but more slender and elongate, and with the third joint of the antennae in the female elongate, not much shorter than the following and quite slender. Otherwise as in the preceding genus. Ovipositor either slightly or strongly exerted behind the abdomen. Antennae of male 13-jointed, as in *Anagrus*, but with the third joint slender and elongate, as in the female. (Plate XII, fig. 1 and 2.)

Parangrus optabilis, sp. nov.

Male; flavous, head more or less sordid or smoky; a large elongate subtriangular spot on either side of the middle line of mesonotum, the apex of these spots reaching nearly to the scutellum; a spot usually triangular on the parapsides, and one on the axillae, dark; abdomen with at least the apical segments more or less dark, blackish or fuscous; all the joints of the flagellum smoky or fuscous.

Female, like the male, but with the thoracic markings generally much fainter, though occupying the same positions; spots on the axillae sometimes not discernable, the abdomen not dark on the apical segments. Length $\frac{3}{4}$ mm.

Hab: Queensland; bred in all localities from the eggs of *Perkinsiella saccharicida*. A very similar form inhabits Fiji, but the material is insufficient to determine whether they are specifically identical.

Paranagrus perforator, sp. nov.

Female; yellow or orange red; head subinfusate, the whole of the flagellum of the antennae, two long triangular spots on the mesonotum, nearly or quite reaching the scutellum, one on the front angles of each of the parapsides, another on each of the axillae, an interrupted band on the first abdominal segment, and an entire one on the second and third, the lateral margins of at least some of the apical segments, and the sheaths of the ovipositor, dark, blackish or piceous. Ovipositor extending well behind the abdomen, for a length equal to that of all the joints of one of the hind tarsi taken together. Length $\frac{2}{3}$ mm.

Hab: Fiji, bred from eggs of Delphacid leaf-hoppers.”

The place of deposit of the types is unknown to me.

POLYNEMA REDUVIOLI Perkins.

“ *Polynema*, Hal.

The single species here described under this genus has a shorter marginal vein than any of the others dealt with in this paper, but it is less punctiform than in some other species, that I have examined.

Polynema reduvioli, sp. nov.

Third and ten following joints in the male elongate, subequal, in the female the third, fourth and fifth are very slender and elongate the following three much shorter and wider, the club about as long as the three preceding

together. The fringe at the apex of the front wings is much shorter than the greatest width of these. The basal joint of the hind tarsi is very long, subequal to the other three joints together.

Black and smooth, except for very fine microscopic sculpture, the three basal joints of the antennæ in both sexes, all the legs, except the apical joints of the tarsi, and the abdominal pedicel are yellow, or brownish yellow. The pedicel is elongate, and about equal in length to the hind coxæ. The surface of the wings is uniformly clothed with short dark hairs. Length 1 mm.

Hab: Hawaiian Islands; parasitic in eggs of *Reduviolus blackburni*.

N.B.—A second species closely allied to this, but differing slightly in color, and with a shorter marginal vein has probably similar habits, as also *P. hawaiiensis* described by Ashmead (Faun. Haw. vol. i, p. 332,) which agrees in nearly all structural points with the one here described. These two species are usually bred from leaves covered with *Aphis* and might easily be supposed to be parasitic on plant-lice by a careless investigator."

ANAGRUS FREQUENS Perkins.

"*Anagrus*, Hal.

Ocelli in a subequilateral triangle, and close together, the posterior very remote from the eyes; antennae of female 9-jointed, scape long, second joint widened, third very short, the fourth and following equal, club about equal to two preceding. Antennae of male filiform 13-jointed, second joint dilated, third also wide on its flat face and short, much shorter than the following, all the other joints subequal. Axillae produced forwards into the scapular region of the mesonotum; tarsi 4-jointed, wings with long apical cilia, much longer than the greatest width of the wing. Abdomen sessile, ovipositor a little exerted. (Plate XII, fig. 4 and 6; antennae.)

Anagrus frequens, sp. nov.

Female: Orange red or reddish yellow, the occiput for a large part, the antennae except the two basal joints, two contiguous or subcontiguous large marks on the front of the mesonotum, one on the anterior end of each of the scapulae, one on the axillae, two or three of the basal abdominal segments more or less, as well as their lateral margins very narrowly, and the sheaths of the ovipositor, dark, blackish or fuscous. Wings hairy, but with a long bare area on the lower side of the apical half. Ovipositor very little exerted.

Male generally like the female apart from the structural differences in the antennae as stated above, and in the usual abdominal characters. Markings as in the female, probably more pronounced as a rule, but similarly situated, the abdomen apically dark above. Length $\frac{5}{8}$ mm.

Hab: Queensland; bred from eggs of Delphacids. An apparently slightly different race inhabits Fiji, but I cannot separate it specifically."

I have seen the type of *Anagrus columbi* Perkins which *in antea* is stated to be the same as *frequens* and *armatus*.

THE FAMILY ELESIMIDÆ.

GENUS EURYISCHIA Koebele.

Myiocnema Ashmead of the Aphelininae is a true synonym as I know by examining the types of the genotype of the latter.

EURYISCHIA SHAKESPEAREI Girault.

This is a synonym of *Myiocnema comperei* Ashmead, the types of which I have seen. In *antea*, *Myiocnema pallida* Ashmead (Howard), is written once for *comperei*; the name *pallida* has no standing in nomenclature. The type number of *comperei* in the U.S.N.M. is really 5342 and not 5442 as on the specimens and as published. The species thus occurs as far south as Brisbane on the east coast and I have seen four females in the United States National Museum which were reared from *Dactylopius vastata* at Swan River, West Australia. I have specimens also from Java (van der Goot) and Koebele reared it from males of *Kermes acaciæ* Maskell on Acacia at Sydney, N. S. Wales, December 21, 1899 (I have seen these specimens).

EURYISCHOMYIA FASCIATA new species.

Female:—Length, 0.90 mm.

Honey yellow, the wings hyaline; cephalic and caudal margins of the propodeum narrowly and three distinct cross-stripes on the abdomen, black, the first cross-stripe at apex of proximal third or not quite, the third longest, some distance before the apex, all complete and tolerably broad. Venation yellow. Wings as in *Euryischia*; under the submarginal vein proximad of the distinct caudal projection which bears two short setæ, a number (about three rows, caudo-cephalad) of short, stiff bristles, shorter than those from the submarginal vein, much coarser than the very fine discal ciliation which terminates before the base of the marginal vein. Scutum with scattered, short, black setæ cephalad. Post-marginal vein longer than the long, slender stigmal, the latter over half the length of the marginal. Caudal tibial spur single, slender. Scape compressed, the pedicel somewhat longer than wide at apex, much longer than funicle 3 which is longest; all funicle joints wider than long. Antennæ capitate, the club longer than the funicle. Scutellum with four bristles. One ring-joint distinct. Hind tibiæ with stiff bristles dorsad.

Described from one female from Perth, West Australia (G. Compere. 837.)

Type: Catalogue No. 19679, U.S.N.M., the foredescribed specimen plus a slide bearing an antenna, hind leg and fore wing.

FAMILY EULOPHIDÆ.

In *antea*, III, p. 184, line 5, for *Queensland* read *Melbourne, Victoria*; p. 213, line 3 from bottom, *jointed* read *joined*; p. 217, line 17 from bottom, *North* read *Northern*; p. 225, footnote 7, line 3, omit the second *i* in *Grotiusiella*; p. 238, line 26, *at* read *and*; p. 287, line 3 from bottom, *species* read *specimen*; page 293, line 9, insert *weaker* before *cephalad*; p. 294, line 9 from bottom, *species* read *genus*. In the Tetrastichini, substitute for the present *Neotetrastichus* Perkins for *Syntomosphyrum* Foerster.

EPICHRYSOATOMUS new genus.

Female:—In my table of entedonine genera runs to *Chrysoatomoides* Girault but differs in that the propodeum bears a pair of median carinæ (distinctly separated) which run to the base of a short, distinct neck; and a semi-circular lateral carina *distad*, its mesal end from the apex of the neck laterad.

its lateral end at the caudal coxa; propodeal spiracle minute. Abdomen with the petiole wider than long, subequal in length to the neck of the propodeum, its second segment occupying about a fourth of the surface. Postmarginal vein moderately long, distinctly longer than the subsessile stigmal. Mandibles tridentate. Parapsidal furrows complete, narrow. Pronotum not visible from above. Scutellum with a single long bristle laterad a little distad of middle; scutum with two long bristles, one on each side caudad.

1. EPICHRYSOATOMUS UNFASCIATIPENNIS new species. Female. Genotype.

Length, 1.50 mm. Dark æneous green, the antennæ and coxæ concolorous, the legs reddish brown except the cephalic femur at about proximal two thirds and less of the caudal femora, these parts of the legs washed with metallic distinctly; tibiæ distad and the tarsi except at extreme apex, white. Scape long, stout, curved; pedicel elongate, thrice longer than wide at apex, distinctly longer than any following joint; funicle 1 ovate, somewhat longer than wide, a third shorter than 2 which is next longest of the flagellum. Club 1 next longest, then 2 which is somewhat longer than funicle 1, club 3 slightly smaller than funicle 1, bearing a distinct terminal spine as long as itself. Head and thorax reticulated scaly, the lines raised; axillæ more finely so. Propodeum glabrous, also segments 2 and 3 of the abdomen, the rest of the abdomen dorsad finely scaly. Segment 3 of abdomen shortest, transverse-linear, 4, 5 and 6 subequal, each about twice the length of 3. Fore wings with a distinct sooty cross-stripe from the apex (moderately broadly) of the very long marginal vein and whole of the stigmal, this stripe broadest at the middle, darker cephalad, narrowing from the middle to each wing margin, hence more or less diamond-shaped.

Described from one female captured November 5, 1914 by sweeping in forest (low uplands, scanty grass), Brooklyn, New South Wales.

Type: No. Hy 3553, Queensland Museum, the specimen on a tag, the head on a slide.

GENUS **HORISMENOPSIS** Girault.

GENOTYPE: **HORISMENUS ANTIOPA** Girault.

RHICNOPELTELLA PURPUREIVENTRIS new species.

Female:—Length, about 1.80 mm. Robust, the ovipositor shortly extruded.

Differs from most of the species in being rather brilliant metallic green, the abdomen, legs and face black-purple; tarsi, except distal joint and the cephalic knees, white. Wings hyaline, the venation fuscous. Body densely scaly. Middle tibial spur long and slender, nearly as long as the basal joint of the caudal tarsus. Tegulæ brown. Three distinct ring-joints which, however, increase in size, the third a little less than half the length of funicle 1. Funicle joints increasing in width distad but of about the same length, the middle one a little the longest, the third somewhat less than half the length of the elongate pedicel. Abdomen compressed. Club ovate, not longer than the funicle, obliquely truncate from one side. Caudal tibial spur single. Club nippleless.

Described from five females on tags in the United States National Museum from Perth, W. Australia.

Types: No. Hy 3554, Queensland Museum, two females on tags plus a slide with antennæ and hind legs. *Paratypes*: Catalogue No. 19145, U.S.N.M.

PARASECODELLA SECUNDA new species.

Female:—Length, 1.40 mm.

Agrees with the description of the genotype but the fore wings are infuscated from the break of the submarginal vein distad to apex and the propodeum is delicately scaly. Knees and tips of tibiae very narrowly reddish yellow. Marginal fringes of the fore wing a little longer than usual. Proximal half of the scape brownish yellow. Pedicel twice longer than wide at apex. Infuscation of fore wing deepest across from the marginal vein. A very short carina on each side of the median carina of propodeum from caudad. Scutellum with four small bristles. Caudal tibial spur rather long. Body scaly reticulate.

Described from one female taken from a window, Brooklyn, New South Wales, November, 1914.

Types: No. *Hy* 3555, Queensland Museum, the female on a tag and a slide bearing a fore wing, the head and hind legs.

ENCYRTOMPHALE PARVULICORPUS Girault.

One female, forest, Brooklyn, New South Wales, November 10, 1914. Like the description but the parapsidal furrows were only cephalad and short. Sculpture very fine, slightly raised scaliness. Axillae oblong, nearly wholly cephalad of the scutellum. Thorax with a short phragma. Ovipositor inserted near base. Tarsal joints short.

RHICNOPELTELLA AUSTRALIA new species.

Female:—Length, 2.00 mm.

Dark metallic green, the hind tibiae, the tarsi except the last joint, tips of middle tibiae and distal half of cephalic tibiae, pale. Fore wing infuscated under the marginal and stigmal veins, across except disto-caudad. Funicle 3 about two thirds the length of the pedicel, 1 like a ring-joint but wider than the three of those joints, no longer. Club enlarged, conic-ovate. Funicle 2 about as long as the four preceding joints, much smaller than 3 and not more than half its length. Antennae black. Allied with *splendoriferella* but the legs differently coloured and funicle 1 is shorter, like the ring-joints.

Described from a female taken at Sydney by A. Koebele.

Type: Catalogue No. 19680, U.S.N.M., the above specimen plus a slide with pair of wings and an antenna.

OMPHALOMOMYIA LIVIDICAPUT Girault.

The face just below the antennae to the mouth (practically the clypeus) may be yellow as the case of three additional Gordonvale specimens seen. There is a groove far laterad on the scutellum, *laterad* of the bristles (thus not a lateral groove as understood).

OMPHALOMORPHA FRATER Girault.

Several specimens of both sexes received from Mr. A. P. Dodd, labelled "G. F. Hill. From *Eugenia* fruit infested with *Dacus* sp.? Other insects. Port Darwin, Northern Territory, December 23, 1914."

OOTETRASTICHUS BEATUS Perkins.

Synonym: The variety *affinis* of Dodd and Girault.

There are on each margin of the abdomen a dot at base and four wider than long spots, the last spot at base of about distal third. The propodeum is metallic except laterad of the spiracles.

From specimens in the U.S.N.M., reared from the eggs of *Perkinsiella saccharicida* at Honolulu.

TETRASTICHODES FROGGATTI Ashmead.

This is a species of *Aprostocetus*. The original description is correct but the scutum is concolorous (i.e. pale golden yellow) broadly at its cephalo-lateral corner; the dot caudad on each parapside is longer than wide (and appears to be on the acute apex of the much advanced axillæ); it is cephalad of a line drawn through the tegulæ. The propodeum is concolorous laterad of the spiracle. The spot at mesal base of the scutellum rounded. The black is really brown-black; that on the abdomen forms three rather distinct cross-stripes at the middle, all rather broad. Propodeum with a median carina only. Marginal fringes of the fore wing a little longer than usual. Stigmal vein tolerably long. Postscutellum dusky. Scutum with a delicate median groove. Abdomen elliptical, narrower than the thorax. Face of pronotum black. Caudal margin of propodeum carinated. Mandibles tridentate. Funicle joints subquadrate but 3 longest, a little longer than wide, slightly shorter than the pedicel, the latter dusky above at base. Club with a distinct terminal nipple. A well-marked species.

From three female types and nine paratypes in the U.S.N.M. A specimen mounted as a male type was entirely black except the legs but the head was missing. A female type head has been mounted on a slide.

PSEUDIGLYPHOMYIA SILVÆ new species.

Female:—Length, 1.45 mm.

Dull orange yellow, the postscutellum and the dorsal thorax laterad of it, the pronotum, parapsides and coxæ pale lemon yellow; fore wing infuscated from apex to base of the marginal vein but a clear area extends along the whole of the marginal vein and along the distal side of the stigmal vein. A U-shaped marking over the centre of the occiput, a twice longer than wide spot on scutellum just out from base at meson, median carina and a spot at mesal apex (caudad) of propodeum; parapsidal furrows and grooves of the scutellum; a dot at extreme latero-cephalic angle of each axilla; cephalic margin of propodeum out to the spiracle; dorsal margin of caudal femur narrowly; apex or more of stigmal vein; and eight cross-stripes on abdomen, the first at base, the last across a little before apex; stripe 4 is a double one (here counted as two), 7 and 8 are suffusedly connected along the meson, making a rather large black area. Extreme lateral angle of pronotum (dorsal aspect) black. Body finely scaly. Funicle 1 a half longer than wide, 2 a little shorter, longer than the pedicel which is somewhat longer than wide at apex; club joints 1 and 2 subquadrate or a little wider than long; club with a terminal spine. Mandibles about 6-dentate.

Described from a female captured by sweeping "fir" bushes, forest lowland, Hawkesbury River, Brooklyn, New South Wales, November 9, 1914.

Type: No. Hy 3556, Queensland Museum, the specimen on a slide.

GENUS GROTIUSELLA Girault.

The antennal club is *solid*.

GROTIUSELLA VARIGUTTATA new species.

Female.—Of the usual size. Dark metallic blue-green, the abdomen yellowish except dorsad, the legs white; caudal coxæ and femora concolorous but the apex of these femora rather broadly white. Caudal margin of pronotum rather broadly except at extreme lateral end, a broad stripe across base of abdomen deeply incised at meson of cephalic margin, followed by two pairs of marginal spots (dorsal aspect), the mesal one wider than long, followed at about middle by a cross-stripe which is not quite complete and has a marginal dot just laterad of it, followed by a pair of marginal spots (the mesal one round-ovate, the lateral a mere dot—dorsal aspect like the lateral ones of the other pairs. From lateral aspect, the lateral spots are nearly as large as the mesal ones and wider than long; the abdomen thus bears spots much as in *multiguttata*. The first pair is smallest), followed by a narrow, incomplete cross-stripe which is obscurely interrupted at meson, followed by a mesal dot at tip, ivory white; also ventral two thirds of face, facial margin of the eyes very narrowly (inside of a broad, broken green line down the eyes) and the vertex except all the central part broadly. Scape white, with a dusky spot on each side of tip. The following parts golden yellow or tawny: Distal part of the "parapsidal furrows" and at extreme cephalic end, margins of axillæ except the cephalic, margins of the scutellum except the cephalic, proximal half of the tegulæ, lateral margins of postscutellum and sutures surrounding insertions of the wings, caudal tibiæ just below the knee, middle coxæ, an obscure area along middle femur ventrad near tip, one on middle tibiæ dorsad near base and distal tarsal joint, metallic purplish. Body finely scaly. Wings hyaline, the venation pale, the postmarginal and stigmal veins subequal. Cheeks metallic. Pedicel barely longer than wide, a little smaller than the subequal funicle joints which are slightly wider than long. Mandibles 6-dentate. Propodeum with a median carina.

Described from a female captured by sweeping upland eucalyptus forest, Brooklyn, New South Wales, November 3, 1914.

Type: No. Hy 3557, Queensland Museum, the specimen on a slide.

GYROLASELLA GEMMA new species.

Female.—Length, 1.25 mm.

Lemon yellow, marked with dark coppery metallic green as follows:—A Greek letter π (π) of the lower case centre of upper half occiput, ocellar area, dorsal pedicel except at apex; distal half of scape dorso-laterad; median line of pronotum rather broadly; a dot at extreme caudo-lateral angle of pronotum; parapsides, the green running to centre of each axilla; a cuneate marking from mesal cephalic margin of scutum extending to apex, the yellow lateral margin of scutum gradually widening distad; scutellum except lateral and apical margins broadly (green between the grooves but caudad narrowing a little, leaving the grooves), postscutellum except lateral and apical margins (hence an acute triangle at its base mesad); a Y-shaped marking at base of abdomen; a narrow cross-stripe on abdomen just before apex; tip of ovipositor valves; four pairs of cross-stripes on abdomen, the first stripe of each pair fainter, the second stripe of the third pair complete or nearly, the others

abbreviated laterad, the first pair joined to the Y at base and narrowly along the meson to the second and third pairs; three very minute marginal dots on abdomen, the second and third opposite the first and second pairs of cross-stripes; propodeum; dorso-lateral base of caudal coxa; each side of the meson of proventer; an oblique dash on mesopleurum just caudad of cephalic coxæ and continuously from this across mesoventer; space between cephalic coxæ; and the mesopleurum between second and third coxæ obliquely from wing insertion. Cross-stripe 4 of abdomen nearly solid and all dark. Wings hyaline, the venation pale. An elbow-like green marking just caudad of each axilla.

Described from one female captured by sweeping forest uplands, Brooklyn, New South Wales, November 5, 1914.

Type: No. *Hy* 3558, Queensland Museum, the foregoing female on a slide.

GYROLASELLA RUSKINI new species.

Female:—Length, 1.50 mm. Pronotum rather long.

Golden yellow, the wings hyaline (the stigmal vein darker), the legs concolorous. Marked with dark metallic blue-green as follows:—A U-shaped marking inverted over centre of occiput, ocellar spots, a narrow, curved line on face along upper third of eye, its dorsal end turned some distance mesad in front of the ocelli, proximal half of pedicel dorsad, a streak down side of the scape; pronotum (excluding the hidden neck); a marking along meson of scutum as in *gracilis* but somewhat more broadly separated from pronotum; median line of scutellum to very near apex, the line clavate; parapsidal furrows narrowly but spreading caudad over a little of each parapside; a very narrow, short, longitudinal line across lateral end of axillæ; a spot just laterad of scutellum and one just mesad of insertion of fore wing; cephalic margin of propodeum rather broadly and irregularly, meson of propodeum more narrowly, caudal margin of propodeum narrowly across meson; a spot cephalad of propodeal spiracle; tip of ovipositor valves; base of abdomen at centre; four transverse marginal spots on abdomen (near base to somewhat distad of middle); eight lines across abdomen, 1 dusky, in a line with the first marginal spot but not connecting; 2 and 3 close together, 2 dusky, complete, 3 dark, incomplete, in a line with the second marginal spot, against 2 and connected along the meson with 4; 4 and 5 like 2 and 3 but 5 nearly reaches the marginal spot on each side and is not against 4; 5 is connected to 6 along meson; 6 and 7 also paired like 4 and 5 but 7 connects the fourth marginal spot; stripe 8 is dusky (not deep metallic like 3, 5 and 7), complete, turning proximad at meson as if to joint 7 but plainly not doing so; first marginal dot of abdomen smallest. Antennæ usual. Mandibles tridentate. Funicle 1 larger than the pedicel, longer than wide, 2 quadrate. Postmarginal vein shorter than stigmal. Scutellum with four bristles in a large square, as in *bifasciatifrons*.

Described from one female caught on forest upland, Hawkesbury River, Brooklyn, N.S.W., November 3, 1914.

Type: No. *Hy* 3559, Queensland Museum, the specimen on a slide; a female on a slide, *cotype* in U. S. N. Museum.

A common species. The lines on abdomen vary somewhat as regards the positions of 2 and 3, 4 and 5, and 6 and 7; also 5 may not be connected along the meson to 6; 3 may be upon 2 and 5 upon 4. The green on the parapside swells triangularly at about middle.

GYROLASELLA BIFASCIATIFRONS new species.

Female.—Length, 1.40 mm. Wings hyaline.

Golden yellow, marked with metallic green as follows: A bow-shaped line across the occiput cephalad of middle; an angular dot in front of each lateral ocellus; two slender lines across the face, the dorsal somewhat below the middle of the eyes, the ventral three the antennal insertions, at the ventral apex of the eyes; tip of scape and base of pedicel dorsad; a uniform line down meson of scutum; a round dot on scutum on each side centrally of this line a little cephalad of middle; a uniform, more thickened line down meson of scutellum except for a short distance on each end; a small triangular spot base of post-scutellum at meson; a dot about centre of the curved, oblique cephalic margin of the axillæ and another one nearly in a line with it longitudinally near caudal margin; a line across the latero-dorsal margin of the transverse pronotum; parapsidal furrows very narrowly; cephalic margin of propodeum very narrowly to spiracle, a subquadrate area suspended from this at about the middle of each side; a V-shaped marking centre of base of abdomen; four slit-like transverse marginal spots on abdomen: five cross-stripes, the first faint, bow-shaped, joined to the V at base and immediately followed by a pair of transverse spots (one on each side of meson) which are about equal to and opposite to the first marginal spot; stripes 2-5 composite, a bow-shaped more obscure ground stripe with a distinct, straight stripe on it, 5 shorter (latero-laterad), none reaching the marginal spots; last marginal spot about opposite stripe 4; a dot on each margin of abdomen near apex and a minute longitudinal one at meson cephalad of but between the marginal dots; also apex of ovipositor valves, apex of tegulæ and caudal suture of axillæ. Legs immaculate. Scutellum with four isolated bristles. Venation yellow, the stigmal vein dusky or infuscated, longer than the post-marginal. A metallic green spot cephalad of the end of the metallic green cephalic margin of propodeum; this spot is acutely prolonged mesad; also the suture of the mesopleurum is metallic green and a transverse spot on cephalic margin of scutum near lateral end. Mandibles 5-dentate, the two outer teeth larger.

Described from one female caught in "fir-bushes," forest lowlands, bank of Hawkesbury River, Brooklyn, N.S.W., November 9, 1914.

Type: No. Hy 3560, Queensland Museum, the specimen on a slide.

SCOTOLINX new genus.

Female.—Belongs to the Ophelinini. Runs to *Ophelimum* Girault but the funicle is only 2-jointed, the antennæ 9-jointed. Abdomen sessile, flattened, ovate. Pronotum well developed but not especially large. Parapsidal furrows complete. Scutellum simple, with four bristles. Axillæ advanced half cephalad of the scutellum. Propodeum only about half the length of the rather large postscutellum at the meson, much longer laterad, its caudal margin straight. Mandibles bidentate, the second or ventral tooth truncate but its dorso-distal apex subacute. Marginal vein shorter than the submarginal, two and two thirds times longer than the stigmal, the postmarginal shorter than the well-developed stigmal. Club without a terminal nipple. Hind tibial spurs distinct, a little unequal.

1. SCOTOLINX GALLICOLA new species. Genotype.

Length, 1.45 mm. Pale honey yellow, the wings hyaline, the funicle, club and five cross-stripes on abdomen, dusky black. First cross-stripe out from base

of abdomen distinctly a short distance, the fifth some little distance before apex, abbreviated laterad, curved and obscurely joined to 4 along the meson. Pedicel dusky, a little longer than wide at the apex, slightly longer than the funicle joints which are a little wider than long and subequal. Club longer than the funicle. Antennæ and cheeks with short, stiff hairs, larger on the club. Venation dusky. Hind wings with about a dozen lines of discal cilia across from the hooklets. Vertex and pronotum with numerous, short, stiff black setæ, longer along the caudal margin of the pronotum. Finely scaly. Parapsides also with the setæ but here they are more scattered. Scutum with but four hairs. Propodeum simple. Small black setæ are present along the lateral margin of propodeum.

In the male, the vertex, meson of pronotum broadly, scutum, parapsides mesad broadly, axillæ, scutellum, propodeum and dorsal abdomen, are dark metallic blue. Otherwise, it is about as in the female (ring-joints not verified).

Described from four males, two females on a card in the U. S. National Museum, labelled "*Scotolinx gallicola* Ashmead. Types. Type No. 12,743, U.S.N.M. 78. Liverpool galls. *Melaleuca lineifolia*."

Habitat: Liverpool, New South Wales and as above.

Types: As above plus a slide with female appendages.

EUPLECTROMORPHA AUSTRALIENSIS (Ashmead).

The *distal fourth of abdomen dorsad* (and somewhat less beneath) is black. Dorsal thorax uniformly scaly, the propodeum glabrous except the finely scaly neck, with the usual strong median carina. Scutum just caudad of cephalic margin and the pronotum with punctures which are setigerous. Funicle 1 longest, over twice longer than wide, 2-4 nearly equal, each somewhat longer than wide, somewhat shorter than the club, each longer than the pedicel. Mandibles present, edentate, obtusely pointed. Belongs to *Euplectromorpha*.

Description otherwise correct. From the type in the U.S.N.M. (the head mounted on a slide).

EUPLECTRUS AGARISTÆ Crawford.

There are obtuse mandibles as in the foregoing species. Original description correct but funicle 4 is distinctly longer than the pedicel, nearly twice longer than wide. From the types.

The genera *Euplectrus* and *Euplectromorpha* thus bear very pale, weak, obtuse mandibles while *Euplectromorphella* bears stronger and dentate ones.

DIAULOMORPHA AUSTRALIENSIS Ashmead.

Head (cephalic aspect) somewhat wider than long, the scrobes deep, long, extending nearly to the cephalic ocellus but not quite joined above, the antennæ inserted below the middle of the face on a level with the ventral ends of the eyes or slightly more dorsad, 10-jointed with two ring-joints (the first very short), the funicle 3-jointed, the third joint of the club with a distinct nipple. Flagellum somewhat compressed. Scutellum with a delicate but distinct, clear lateral groove. Postmarginal vein somewhat longer than the long, slender stigmal, the latter slightly less than half the length of the marginal; wings hyaline, the venation yellow-brown. Scape white, reddish above at tip, the pedicel nearly all dark metallic, rest of antennæ and the legs except the coxæ, reddish yellow. Hind tibial spurs distinct. Joints of funicle and club armed with flattened

hairs. Funicle 3 quadrate, larger than the pedicel; club 1 largest, wider than long, 3 at apex with an inset tubercle-like joint which bears the terminal nipple and appears to be articulated (if so, club 4-jointed). Mandibles 6-dentate. Propodeum with a delicate but distinct median carina, no others but a sulcus runs along the caudal margin from the meson to about opposite the not very large spiracle and which narrows mesad. Postscutellum large, nearly half the length of the scutellum, sculptured like the latter. Propodeum subglabrous between the spiracles, otherwise scaly like the rest of the thorax. Axillæ much advanced. Parapsidal furrows cephalad, very short, the scutum with the usual constriction cephalad. Segment 2 of abdomen occupying about one third of the surface, mostly smooth, rest of the depressed abdomen delicately scaly. Scutellum with a finer surface than the scutum, the latter very densely scaly-punctate. Head sculptured like the thorax.

Redescribed from the type in the U. S. National Museum. "Australia—Koebele."

HEMIPTARSENOIDEUS new genus.

Female:—In Ashmead's table runs to *Hemiptarsenus* Westwood but differs in bearing four funicle joints and two club joints. Head triangular, the antennæ inserted in the middle of the face, the long scape extending above the ocelli. Club with a distinct terminal nipple. Marginal vein long and slender, somewhat longer than the submarginal, the postmarginal subelongate, distinctly longer than the well-developed stigmal. Abdomen with the second segment occupying about a fifth of the surface; a short distinct petiole is present, the body of the abdomen conic-ovate. Form slender. Proximal joint of caudal tarsi elongate, the caudal tibial spur distinct. Legs slender. Spiracle of propodeum minute, round, a little caudad of cephalic margin, lateral carinæ present, very delicate, straight, a median carina at base but rather weak and one third complete. Axillæ but slightly advanced, widely separated. Pedicel smallest of the antennal joints. Two ring-joints, the first very short. Mandibles 4-dentate. Stigmal vein about a fourth the length of the marginal.

HEMIPTARSENOIDEUS SEMIALBICLAVA new species.

Female:—Length, 1.45 mm.

Metallic purplish green, the abdomen black-purple, the wings hyaline, the venation brownish; coxæ and caudal femora concolorous, also distal three joints of caudal tarsus and a little over distal third of caudal tibiæ; scape (except above at middle), second club joint with its terminal spine and rest of legs, white except the distal three tarsal joints. Funicle 2 longest of the funicle, subequal to 1, 3 and 4, each slightly shorter in succession; 1 is nearly as long as the body of the scape and about $3\frac{1}{4}$ times longer than wide; 4 only about two thirds the length of 2, subequal in length to the club. Pedicel a little longer than wide at apex, not half the length of 1. Ring-joint 2 rather large. Thorax finely scaly, the propodeum subglabrous between the lateral carinæ, except near proximal margin, the abdomen much smoother, shining. Postscutellum shining. Middle femora metallic.

The male is about the same except in the abdomen and the antennæ, the latter bearing long, serrated or rather short-plumose rami one each from funicles 1-3 (from the same side and originating near apex), these rami are much longer

than funicle 4 which is longest, elongate, 1 shortest, only somewhat longer than wide, the distal club joint next shortest, then funicle 2, club 1 and funicle 3, the latter about thrice the length of 1.

Described from two males, three females in the collections of the United States National Museum, labelled "840. Perth, West Australia. G. Compere."

Types: Catalogue No. 19146, U.S.N.M., one pair on tags and a slide bearing female hind legs and antennæ and male antennæ. *Cotypes*: No. Hy 3561, Queensland Museum, several broken specimens on tags.

HEMIPTARSENOIDEUS SEMIALBICLAVA SECUNDUS new variety.

The same as the typical form but the propodeum is scaly farther laterad, apparently lacks the delicate abbreviated median carina at base and funicle 1 is somewhat shorter, shorter than 2 which is longest and subequal to 3. The scape is all black and somewhat shorter. Compared with type of the typical form.

Described from a female captured by sweeping trees and grass in a civic park, Muswellbrook, New South Wales, October 24, 1914.

Type: No. Hy 3562, Queensland Museum, the specimen on a tag, the head and a hind leg on a slide.

A second female at Brooklyn, New South Wales, forest, November 5, 1914.

CREMNOEULOPHINI new tribe.

Differs from Hetreulophini in bearing two distinct spurs on the hind tibiae.

CREMNOEULOPHUS new genus.

Male:—Form elongate, robust. Head, cephalic aspect rounded triangular, the stout antennæ inserted a little above the middle of the face, 13-jointed with two ring-joints, the club 4-jointed. Pronotum rather large. Parapsidal furrows distinct, nearly complete. Scutellum with a lateral grooved line. Propodeum with a distinct median carina and no others. Marginal vein about two thirds the length of the submarginal, the postmarginal and stigmal veins both short, subequal, about a fifth the length of the submarginal. Middle and caudal tarsi 5-jointed, the other not seen. Hind tibial spurs stout. Axillæ advanced nearly wholly cephalad of the scutellum. Scutum long.

CREMNOEULOPHUS GIGANTEUS new species. Genotype.

Length, about 6.00 mm.

Dark metallic green, the abdomen dark purple, the wings hyaline, the venation brown; tarsi except the last joint and more or less of the knees, white; Cephalic knees and tibiae brown. Body densely scaly, the scutum coarsely so and with scattered pin-punctures, the scutellum with a line of minute punctures mesad along the lateral groove. Marginal fringes of the fore wing minute, the discal ciliation apparently absent. Mandibles tridentate, the third tooth truncate. Segment 2 of the abdomen occupying a fourth of the surface. Lower face with scattered punctures.

Described from two males in the U.S.N.M. labelled "From *Apiomorpha maliformis* Fuller MS., West Australia. Through Townsburys, October, 1898."

Types: Catalogue No. 19682, U.S.N.M., the above specimens on a card and a slide bearing a head, hind and middle legs.

GENUS ZAGRAMMOSOMA Ashmead.

This genus bears two ring-joints so that it is the same as *Atoposoma* Masi and the name takes precedence. My single species (*pulchra*) of *Zagrammosoma* from Australia is therefore misplaced and is the genotype of *Parzagrammosoma* new genus which is characterized by bearing but a single, usually concealed, ring-joint.

GENUS PSEUDIGLYPHOMYIA Girault.

This is the same as *Cirrospilus* in the North American sense (*Cirrospilus flavicinctus* Riley).

GENUS SYMPIESOMORPHALLEUS Girault.

This is a synonym of *Cirrospiloideus* Ashmead which was erroneously described.

FAMILY PERILAMPIDÆ.

GENUS EPIPERILAMPUS Girault.

This is a synonym of *Trichilogaster* Mayr. The following species besides my own:

acaciæ = *dicoloris* (Froggatt).

acaciæ = *longifoliæ* (Froggatt).

maideni (Froggatt) Mayr.

pendulæ Mayr.

Froggatt does not *describe* the species *maideni*. This is such a case of carelessness as to cause astonishment. His pseudo-description represents nothing like the actual specimens. I am forced to accept Mayr's descriptions. In *Trichilogaster acaciæ* = *longifoliæ* (Froggatt) the base of the abdomen is orange except narrowly at meson; the antennæ are not inserted below the eyes but in the middle of the face; the brown cloud on the fore wing is from the apex of the submarginal vein and the rest of the wing is subhyaline. Venation reddish brown. Four females in the U.S.N.M. labelled "From galls on *A. longifoliæ*. Bot. garden. 15.11.11. *T. a.* = *longifolia*, det Frogg." Of *maideni* in the same collection, two females "From galls on *Acacia maideni*. Bot. gardens." The wings of *maideni* are clearer but the cloud is in the same place. Both the species *longifoliæ* and *maideni* bear two caudal tibial spurs which are stout and unequal.

GENUS MELANOSOMELLA Girault.

This is a synonym of *Terabiella* Ashmead of the Pteromalidæ and the genotypes are identical. The female scape is compressed. The punctures on the face are very minute. Types examined.

GENUS CÆLOCYBOMYIA Girault.

This is a synonym of *Cælocyba* Ashmead, formerly of the Pteromalidæ.

The original description of *Cælocyba nigricincta* Ashmead errs in stating the metathorax to be black; it is so laterad only rather broadly and at base of

meson quadrately and along its cephalic margin; there is a transverse, narrow black line across scutellum just before its apex, but abbreviated laterad, running between the two bristles; rest of scutellum and caudad to abdomen lemon yellow. On the abdomen six very distinct black stripes, the first and second often combined, the distal two with cephalic convexities at meson. The axillæ may have a more or less distinct fuscous blotch cephalad. Pronotum lemon yellow. Orange yellow. Funicle 2 only somewhat longer than 1. The species runs very close to *novisexfasciata* Girault and is very likely the same. From the types of the genotype of *Calocyba*.

GENUS BRACHYSCELIDIPHAGA Ashmead.

Removed from the Pteromalidæ. The original description of the genotype is correct. The spot on the scutum is subovate or longer than wide and a little caudad of centre at the meson; the spot on the inner angle of the parapside is over the caudal end of that sclerite and the cephalic end of the axilla. The scutellum is brown-black except lateral and apical margins broadly; the abdomen is "dusky or brownish" dorsad only, except at base where there is a yellow triangle on each side of the meson, the apex mesad. The marginal vein is about a half longer than the stigmal. Caudal tibial spur single. Postmarginal vein slightly longer than the stigmal, the marginal longest.

Differs from *Calocybella* Girault in bearing but a single caudal tibial spur, the stigmal vein is longer in proportion to the marginal and the three ring-joints gradually enlarge. It comes closest to *Trichilogaster* but that genus should bear two caudal tibial spurs (e.g., *ater* does) and the marginal vein is thickened. Differs notably from *Calocybelloides* in lacking one caudal tibial spur.

From the types.

PARACÆLOCYBA new genus.

Genotype: *Calocyba acincta* Girault. Transferred from the Pteromalidæ. Includes *C. variifasciata* Girault and the following species.

Differs from *Calocybomyia* in lacking a sclerite between scutellum and postscutellum and one caudal tibial spur and in bearing a solid club.

PARACÆLOCYBA MINUTA new species. Female.

Smaller than usual. Length, about 1.00 mm. Bright orange yellow, the following parts black: Distal half of abdomen ventrad and dorsad, three narrow cross-stripes on proximal dorsal abdomen (or distal fourth is black above and below, proximad dorsad with four stripes), the first just out from base and interrupted on each side of the meson; a line across upper face of pronotum and lateral margin of propodeum. Scutum, scutellum and parapsides studded with short, black hairs as in the other species. Caudal aspect of head, postscutellum and propodeum lemon yellow. *Second tibial spur very small*, distinct. Mandibles tridentate. Three ring-joints; funicles 1-2 subequal, the others gradually enlarging, 5 largest, much wider than long, 3 and 4 subequal. Wings hyaline, the venation pale yellow. Antennal club apparently solid. Antennæ inserted at the clypeus.

Described from four females captured by sweeping "fir bushes" in blossom, forest lowlands, Brooklyn, New South Wales, November 1-9, 1914. A common species.

Types: No. Hy 3563, Queensland Museum, a female on a tag plus a slide bearing heads and caudal legs.

Paratype: Catalogue No. 19142, U.S.N.M., a female variety *nigriventris nova* on a tag, the whole abdomen black (except ventro-proximal half, a yellow line across just out from base and a yellow dash just distad of this, one on each side of the meson).

PERILAMPOIDES AURANTISCUTUM new species.

Female.—Length, 3.00 mm. Deep orange yellow, the following parts purplish black: The abdomen except a triangle at basal lateral margin, the vertex and occiput (rest of head suffused slightly with reddish), face of pronotum and an inverted T-shaped marking in the centre of the scutellum (often obscure or absent). Antenna suffused with purple. Fore wing with a brownish yellow cross-stripe from near apex of the submarginal vein, otherwise hyaline, the band interrupted caudad of middle. Venation dusky yellowish, the stigmal vein subequal to the marginal, the postmarginal somewhat longer, all three pale. Second tooth of mandibles broadly truncate. Caudal tibial spur single. Scape rather thick; pedicel stout, oval, longer than funicle 6 which is largest yet somewhat wider than long; funicle 4 narrower than 2 and 3 which are subequal; ring-joint somewhat wider than long; funicles 1-5 prolonged a little from one lateral apex, 1 smallest, not a third the size of 6. Club as long as the scape. Axillæ slightly separated. Body shining but with delicate sculpture. Propodeum short, nuncinate. Pubescence sparse, short, black, thicker on pronotum.

From three females on a card in U.S.N.M. labelled "*Paraterobia* Ashm. Type No. 12719, U.S.N.M. Horn Gall on Iron Bark. Tumut. 7.10.99. 92."

Types: No. Hy 3564, Queensland Museum, Brisbane, the above females and a slide with a head, hind legs and a middle one.

This is *Paraterobia nigriceps* Ashmead MS. of the trydymine *Miscogasteridæ*.

CÆLOCYBELLOIDES BIOCULATUS new species.

Female.—Length, 3.50 mm.

Reddish brown, the head yellow-brown, the prothorax and legs except the black proximal half or two thirds of the hind coxa, honey yellow. The following black parts: The mesal apices confluent of the axillæ, a rather small round spot at the latero-cephalic corner of the axilla; thorax transversely laterad of the postscutellum, propodeum, dorsal abdomen, hind coxa proximad, a small triangular sclerite just above hind coxa, genal suture, ventral meson and apex of the abdomen and mesothoracic venter. Venation yellow-brown, the fore wing with a yellow-brown, large, ovate area with its broader end against the bend of the submarginal vein, its narrow end against the tip of the stigmal. Marginal and stigmal veins subequal, the postmarginal pale yellow, a little longer. Hind tibial spurs double. Pedicel elongate, two and a half times longer than wide at apex; ring-joints each a little longer than wide; funicles 1-2 quadrate, the others shortening. Scape with a long-linear expansion, widening toward the apex. Thorax finely lined but with numerous scattered punctures. The scutellum with a median carina from base to apex of proximal third from thence mesad more finely scaly. Spots on axillæ and the black along the genal suture, jet.

Described from the type female and two paratype females in the U. S. National Museum labelled "94. Turpentine Gum Gall. Sydney, 1898, August 20. *Alloderma maculipennis* Ashmead."

Type: Catalogue No. 12717, U. S. National Museum, a slide bearing type fore wing and paratype hind legs and antenna and the above specimens.

This is *Alloderma maculipennis* Ashmead MS., placed in the trydymine Miscogasteridae.

CCELOCYBELLOIDES MEDIOLINEATUS new species.

Female:—Length, 2.35 mm.

Pale golden yellow, the wings subhyaline, the venation brown, the following parts black: Upper occiput centrally to vertex, face of pronotum, a moderate line down meson of scutum, dorsal aspect of the parapsides except the extreme cephalic end, the thorax caudad of the axillæ, the postscutellum and propodeum excepting rather broadly, the meson; caudal margin of scutum about as broadly as the median line of that part; and five brown-black stripes across dorsum and lateral aspects of the abdomen, the first well out from the base at about proximal fourth or fifth, the next two close to it, 3 broadly bowed, 4 arcuate, 5 also but much smaller and not far from the black apex. From the lateral aspect the stripes are more uniformly distributed. Venter of abdomen and most of that of thorax, black. Antennæ black, except proximal third of the scape (more ventrad); ring-joint 1 longer than 2; funicle 1 somewhat longer than wide, somewhat shorter than the pedicel, longest of the funicle. Hind tibial spurs double. Post-marginal vein a little longer than the stigmal. Propodeum with curved lateral carinæ. Body subglabrous, shining, very minute hairs scattered over the surface. Axillæ with a minute carina between them.

Male (apparently) the same but entirely purplish black including coxæ, the legs pale straw yellow. Funicle 1 subequal to the scape, nearly twice longer than wide; first ring-joint quadrate, longer than 2; funicles 4-6 subequal, each somewhat longer than wide, distinctly longer than the pedicel which is no longer than wide.

From two males, five females labelled "Cynips Galls. French, Victoria, 20-1-96."

Types: Two males, two females on two cards. Cat. No. U.S.N.M. 19683.

Paratypes: Two females in Queensland Museum, Brisbane, and 1 female on card, 3 females in all.

PERILAMPOMYIA new genus.

Runs to *Perilampella* but bears only one tibial spur on hind legs. Scutellum convex, overhanging the propodeum.

PERILAMPOMYIA NOTATIFRONS new species. Genotype.

Female:—Length, 2.35 mm.

Black, the wings subhyaline, the venation brown-black; the scape and legs except hind coxæ, lemon yellow, and also a conspicuous, rectangular (longer than wide) marking occupying the space between bases of the antennæ and the mouth or apex of the head. Abdomen lemon yellow with five tolerably broad cross-stripes of brown-black, the first well out from base. Pedicel yellowish brown ventrad; scape black dorso-distad (distal half). Tegulæ brown. Marginal vein

about four times longer than wide, about two thirds longer than the stigmal, the latter a little longer than the postmarginal. Axillæ slightly widely separated, terminating mesad more than half way between meson and the ends of the parapsidal furrows. Thorax densely polygonally scaly, the abdomen and head more faintly so. Propodeum short at the meson. Abdomen globose, larger than the rest of the body. Scape slender, two distinct ring-joints, the second larger than the first; funicle joints a little longer than wide, the funicle cylindrical, the joints gradually shortening distad, 6 quadrate. Pedicel as large as funicle 1. *Male*, the same but the abdomen nearly all black and the antennæ nodular, the funicle joints swollen at base and tapering distad and each with a whorl of rather long stiff bristles around the swollen portion; also the pedicel is no longer than wide at apex and all funicle joints are distinctly longer than in the female.

Described from two males, seven females in the U. S. National Museum collections labelled "850. Swan Riv. W. Austr. G. Compere Coll."

Types: Catalogue No. 19147, U.S.N.M., two females plus a slide with the appendages. *Cotypes*: No. Hy 3565, Queensland Museum, two males, three females on tags.

PARELATUS new genus.

Genotype: *Elatus ater* Girault, male.

Elatus is described as bearing two ring-joints in the antennæ.

FAMILY PTEROMALIDÆ.

In *antea*, III, p. 330, line 23, *Peterosema* read *Pterosema*; page 342, line 19, *Paracloclisis* read *Paracroclisis*.

PTEROMALUS PUPARUM (Linnæus).

What is accepted as this species occurs in Australia. There are specimens in the U. S. National Museum labelled "Reared from orange butterfly pupa, June 14, 1898, W. W. Froggatt." Evidently from near Sydney and introduced.

PARURIELLA VIRIDIS new species.

Female:—Length, 1.60 mm.

Similar to *australicensis* but the lateral carina of the propodeum is absent. The male is about the same but the propodeum very short at the meson.

Described from two males, one female on tags in the U. S. National Museum, labelled "H. 98. Boggabri, New South Wales. Reared from seeds of grass (*Panicum* sp.). Fry. January 23, 1909."

Types: Catalogue No. 19686, U.S.N.M., the foregoing specimens plus a slide bearing female head, fore wing and caudal tibia.

GENUS CŒLOCYBA Ashmead.

Belongs to the Perilampidæ which see.

GENUS TERABIELLA Ashmead.

Belongs to the Perilampidæ which see.

GENUS BRACHYSCELIDIPHAGA Ashmead.

Belongs to the Perilampidæ which see.

GENUS EURYCRANIUM Ashmead.

Synonymic with *Anysis* Howard and the genotype differs from the genotype of *Anysis* (*australiensis*) in having funicle 3 longer than wide and the abdomen all reddish brown except near tip and narrowly across base; the wings are subhyaline. The scutellum is very finely transversely lined but distad of an indicated cross-suture, it is coarsely scaly (as also in *australiensis*). In *australiensis* the abdomen is suffused with brownish. In the male *alcocki*, the abdomen is all concolorous, the antennæ not clavate as in the female but much longer and filiform, 9-jointed, the third club joint not very distinctly articulated, the pedicel very short, fuscous, funicle 1 elongate, subequal to the club, 3 longer than wide, subequal to club 1. The male flagellum is clothed with spearlike, flattened setæ. Types of genotypes compared and slides made.

EURYCRANIELLA new genus.

Genotype: Eurycranium bæusomorpha Girault.

Since *Eurycranium* equals *Anysis* and the latter belongs to the Miscogasteridæ, the above species must represent a new genus. It differs from *Anysis* in other characters.

GENUS ANYSIS Howard.

Belongs to the Miscogasteridæ which see.

MUSCIDEOIDEA new name.

Muscidea Girault is preoccupied by *Muscidea* Motschulsky, a valid genus as I find later, so that the above name is proposed for the first.

OPHELOSIA CRAWFORDI Riley.

The genus is correctly described by myself. The genotype female bears a very scanty tuft of short setæ just at the side of the petiole on segment 2 of abdomen. The colour of the genotype is light yellow, the part of the propodeum laterad of the prolonged part dorsad and the antennal club, black. There is no æneous on the thorax as in *saintpierrei*. The male antenna is 8-jointed with one ring-joint, the club solid, the funicle joints as in the male *Eurytoma*; the pedicel is subglobular, funicle 1 longest, stout, a third longer than wide but shorter than the club. Funicle 4 oval, a little longer than wide. The lateral parts of the mesoscutum in the female are not black.

The types are three females, two males on tag, a male antenna on a slide. Catalogue No. 1510, U.S.N.M.

OPHELOSIA HYPATIA new species.

Female.—Differs from *crawfordi* in being much darker and in having metallic colour on the thorax dorsad. From *saintpierrei* in having all the antenna black except the yellow scape and the entire abdomen and hind tibia; also the propodeum is black, except the middle prolonged portion, the general colour reddish brown. From *pinguis* in having the entire abdomen black and so on. The metallic colour shows mostly along the caudal margin of the scutum and the cephalic margins of the axillæ. Axillæ and the scutellum at apex, glabrous. Ring-joint or funicle 1 wider than long, 2 longest, slightly longer than wide, the following three joints a little wider than long, larger than 1. Fore and hind femora compressed. What appeared to be the male was dark metallic green with the legs and antennæ all dark except tarsi, the wings as in the female. The

male scape is yellow, the funicle less excised than with *crawfordi* and there are two ring-joints, the first very short but distinct. Vertex punctured in both sexes. Middle tibiæ dusky.

Described from four females, two males in the U.S.N.M. labelled "*O. Crawfordi*. From Icerya. Alex. Craw. California. Imported from Australia. G. Compere, July, 1900." Also, a large series in the U.S.N.M. labelled "12. Sydney, N.S.W."

Types: Catalogue No. 19687, U.S.N.M., a pair on tags plus a slide with antennæ of both sexes and the female hind leg (Australia). *Cotypes*: No. *Hy 3566*, Queensland Museum, two females on tag.

OPHELOSIA VIRIDITHORAX new species.

Female:—Length, 1.50 mm.

Yellow-brown, the abdomen purplish black, also the antennal club, the propodeum entirely and the centre of the occiput narrowly; ocellar area and the thorax, except pronotum, dark metallic green; venter of abdomen yellow brownish. Caudal femora and tibiæ dorsad at distal two thirds, purplish. Otherwise about as in *hypatia*.

From one female on a tag in the U.S.N.M. labelled "Australia. Koebele."

The type is in the U.S.N.M. Catalogue No. 19688.

OPHELOSIA BIFASCIATA new species.

Female:—Of usual length.

Differs from the other species in being uniformly reddish brown, the axillæ very slightly aneous, the flagellum, cephalic margin of the propodeum (broader laterad), a tolerably narrow stripe across base of abdomen and another across its middle (just before apex of segment 2), black. Also the caudal tibiæ and the dorsal margin of the caudal femora. Funicle 1 like a large ring-joint, distinctly wider than long, 2 subquadrate, longest, 5 widest. Pedicel longer than any funicle joint.

Described from one female in U.S.N.M. labelled "Australia. Koebele. From Dep. Agric. 12." Associated with coccinellid larvæ.

Type: Catalogue No. 19689, U.S.N.M., the above specimen on a tag.

OPHELOSIA VIRIDINOTATA new series.

Female:—Of the usual length. Yellow-brown, like the other species but marked with dark metallic green as follows: Centre of occiput narrowly, a diamond-shaped marking centre of scutum, its widest portion cephalad of the centre, extending also on to meson of the pronotum, cephalic and caudal margins of scutellum and its median line, all rather broadly, mesocephalic half or nearly of each axilla, postscutellum, a broad stripe across cephalic margin of the propodeum and all of abdomen except proximal fourth which is more or less concolorous. Flagellum and the caudal two pairs of tibiæ, black. Funicle joints widening distad, 2 subquadrate.

Described from a female labelled "Australia. Koebele."

Type: U.S.N.M., the above female.

All of the foregoing species have heretofore passed for the genotype.

GENUS TOMOCERA Howard.

Belongs to the Cleonymidæ which see.

EURYDINOTELLA AUSTRALIA new species.

Female:—Length, 1.65 mm.

Differs from the genotype in that segment 2 of the abdomen is somewhat longer than 3, the two occupying half of the surface, the postmarginal vein is distinctly longer than the stigmal and there is only an abbreviated (very short) lateral carina on propodeum from base to the mesal side of the minute spiracle. Also the club bears a "fourth" minute joint ending in a short terminal spine. Pedicel concolorous with the rest of the flagellum, the tip of the scape also but rest of scape yellowish brown. Proximal half of caudal coxæ above metallic green. Postmarginal vein not as long as the marginal. A round fovea just mesad of the short lateral carina at base of propodeum. Segment 4 of abdomen as long as 5 and 6 combined, shorter than 3. Whole of thorax scaly punctate, the abdominal petiole scaly. Otherwise agreeing with the description of *prima*. Occiput immargined.

Described from one female caught on a window, Brooklyn, N.S.W., Nov., 1914.

Type: No. *Hy* 3567, Queensland Museum, Brisbane, the specimen on a tag; fore wing, hind tibiæ and the head on a slide.

GENUS NEOPTROCERUS Girault.

In *antea*, original description, line 1, for *Roptrocercus* Ashmead read *Tropidogastra* Ashmead.

GENUS PACHYNEURON, Walker.

Female:—In Ashmead's (1904) table the following species run to *Pachyneuron* Walker but segment 2 of the abdomen occupies only somewhat over a fourth of the surface. The parapsidal furrows are two thirds complete from cephalad. Both mandibles 4-dentate. Antennæ 13-jointed with two ring-joints. Petiole of abdomen somewhat longer than wide. Propodeum with a distinct neck, without a median carina, the lateral Y-shaped, the tail of the Y caudad and not reaching the apex of the neck, one branch going to the meson at base (really a loop—the opposite sides joined across the meson), the other to a point on cephalic margin a short distance mesad of the spiracle. Marginal vein slightly widening distad, two and a half times longer than wide at apex, the stigmal and postmarginal very narrow and elongate, the first subequal to the thickened marginal, the postmarginal distinctly longer than the marginal. A delicate, narrow spiracular sulcus. Maxillary palpus 4-jointed, the last joint longest. Genal suture absent. Antennæ inserted a little above ventral ends of the eyes, below middle of face. Axillæ nearly joined. Head wider than the thorax.

PACHYNEURON EMERSONI new species.

Female:—Length, 1.35 mm.

Very dark metallic green-black, the wings hyaline, the venation blackish, the body scaly except the much less so propodeum and body of the abdomen, the latter glabrous. Abdomen and propodeum brown, washed slightly with metallic

greenish dorsad. Coxæ light brown; rest of legs except the femora which are lightly brownish dorsad and the scape pale yellowish white. Flagellum dusky, also tip of scape a little dorsad, the funicle joints subquadrate, the last two slightly wider than long; pedicel somewhat longer than funicle 1. Petiole of abdomen sometimes brown. Pronotum glabrous.

The male is the same but the femora are white like the tibiæ and the antennæ filiform and more slender, the two ring-joints shorter, the funicle joints longer, subequal, each about a half longer than wide, the pedicel not as long as wide; the flagellum is distinctly more hairy than with the female.

From several specimens of each sex on separate tags labelled "878. Swan River, W. Austr. G. Compere, Collector." Also a slide bearing female head and hind leg, male hind legs and antennæ. Catalogue No. 19691, U.S.N.M., two females on tags plus the slide.

Paratypes are two females, one male on tags in the Queensland Museum, No. *Hy* 3568.

PACHYNEURON KINGSLEYI new species.

Female:—Length, 1.50 mm.

Differs from *emersoni* in its greater suture, the uniformly dark green body, the concolorous coxæ, the subconcolorous femora and in having the tibiæ concolorous dorsad, except broadly at tips (more so on cephalic tibiæ). Scape except at apex (distal fourth), trochanters, knees, tips of tibiæ and the tarsi yellow. Otherwise the same or nearly. The propodeum shows slight scaly sculpture. One mandible not seen.

Described from one female captured by sweeping in the forest, Brooklyn, N.S.W., October 31, 1914 (partly boggy).

Type: No. *Hy* 3569, Queensland Museum, the specimen on a tag; hind tibiæ and a head on a slide.

NOTE ON NILSSONIA MUCRONATUM (DE VIS)

FROM THE CRETACEOUS OF WESTERN QUEENSLAND.

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(Plate XXIV.)

THE present note is the result of an examination of the specimen described by the late Mr. De Vis as *Pterophyllum mucronatum*, sp. nov., in the Annals of the Queensland Museum.¹

The description and figures of De Vis do not correspond with one another and I was permitted, through the courtesy of the Director of the Museum, to examine the original specimen (No. F15/967) and to undertake its re-description.

DESCRIPTION OF THE SPECIMEN.

The specimen is a single incomplete pinnate frond; it has a length (incomplete) of 12.5 cm. and is 5.8 cm. wide at its lower end and 4.8 cm. at the upper end.

The pinnae are alternate, fairly uniform in shape and size, and are close together; they are from 2.6 cm. to 3 cm. long and 6 to 7 mm. wide; they are inserted on the upper surface of the rachis which has a width of from 1.5 to 2 mm. The pinnae narrow very slightly near their junction with the rachis; the upper margins of the pinnae are straight and make a wide angle (about 80°) with the rachis; the lower margins are at first parallel with the upper, but they curve upwards rather suddenly at a distance of about 2.5 cm. from the rachis, forming truncated pointed tips to the pinnae.

The venation is not well defined, but as far as can be seen there are 10 to 12 veins per pinna and they appear to be very slightly divergent. (See Plate, figs. 3 *a* and *b*.)

OBSERVATIONS.

The specimen shows the frond viewed from the lower surface, but over the greater part the actual material of the pinnae has been removed, leaving the impression of the upper surface. At a few places the material replacing the pinnae is preserved and it is on these that the venation can best be observed.

The rachis projects markedly above the level of the remainder of the frond and so it hides, for the most part, the manner of attachment of the pinnae to the rachis. Fortunately in one or two places the rachis is broken away and the pinnae are seen to have continued almost to the middle of the rachis before joining it. (See Plate, fig. 2.) This method of attachment at once shows that the specimen was incorrectly placed in the genus *Pterophyllum*, where the attachment is lateral.

¹ Ann. Q'land Mus. No. 10, 1911, p. 1, pl. ii.

The general appearance of the frond, the method of attachment of the pinnæ and their general shape, particularly the truncate tips, are characteristic of *Nilssonia*. In the slight narrowing of the pinnæ near the base the specimen diverges from the typical *Nilssonia*. An apparent slight divergence of the veins is mentioned in the description. The venation only shows on portions of a few pinnæ and it is quite possible that the slight apparent divergence is accidental.

Neither of these two differences from the typical *Nilssonia* is sufficiently marked to warrant a separation without further material.

As far as can be ascertained the only species of *Nilssonia* which this one approaches is *N. schauburgensis* (Dunker)² which occurs in the Wealden of North Germany and England. There is a general resemblance between the two species, but *N. mucronatum* is larger than *N. schauburgensis*, and this in addition to the points noted above seems sufficient to justify its separation as a distinct species.

LOCALITY AND STRATIGRAPHICAL HORIZON.

This specimen was collected by Mr. F. L. Berney and presented to the Queensland Museum. It comes from Wyangarie Station, on O'Connell Creek, situated to the south of Richmond, which is on the Townsville-Cloncurry Railway. It occurs in rocks belonging to the Winton Series. Mr. B. Dunstan, the Chief Government Geologist of Queensland, in his recent revision of the Geological Record for Queensland, indicates a series of freshwater beds in Central and Western Queensland, on the western side of the main divide, which he calls the Winton Series. This series contains carbonaceous beds and coal-seams and overlies the marine Lower Cretaceous Series known as the Rolling Downs Formation. In a similar stratigraphical position in the coastal area of Queensland are the Burrum Coal Measures in the Maryborough district. The Burrum Coal Measures contain workable coal-seams.

Up to the present few fossil plants have been obtained from the Winton Series, but an abundant flora is known in the Burrum Coal Measures. The Burrum flora, in its general aspect, is distinctly different from that of the so-called Trias-Jura System, including the Ipswich and Walloon Coal Measures.

It is not likely that such a specimen as the one described here is an isolated one and its presence leads to the hope that further collecting from the same area may bring forth more examples.

It is of interest to note that no specimens resembling *Nilssonia mucronatum* are present among the flora of the Burrum Coal Measures as at present known.

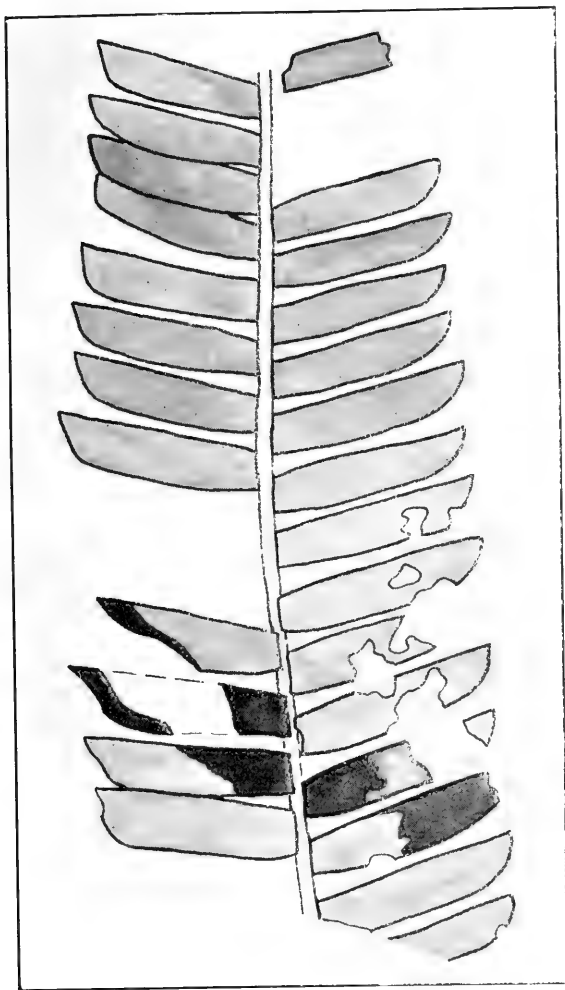
EXPLANATION OF PLATE XXIV.

Fig. 1.—*Nilssonia mucronatum* (De Vis). Wyangarie Station, Q. ; natural size.

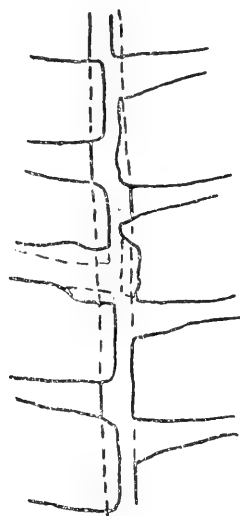
Fig. 2.—*Nilssonia mucronatum* (De Vis). Portion of a frond showing attachment of pinnæ to rachis. (x2.)

Fig. 3 a and b.—*Nilssonia mucronatum* (De Vis). Two fragments of pinnæ showing venation. (x2.)

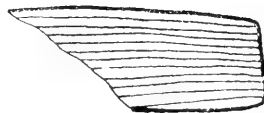
² Palæontographica, Band xix., Taf. xxxiii.



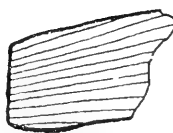
1



2



3a



3b

NILSSONIA MUCRONATUM (De Vis).

Face page 232.

NOTE ON A SPECIMEN OF ANNULARIA

FROM NEAR DUNEDOO, NEW SOUTH WALES.

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Assistant Lecturer in Geology, The University of Queensland, and

Honorary Palæontologist to the Queensland Museum.

(Plate XXV.)

A SMALL collection of specimens of *Glossopteris* was recently donated to the Queensland Museum. They were collected by Mr. W. Elliott Nixon at a spot about eight miles from Dunedoo, New South Wales, and forwarded by him to the Museum. Most of the specimens are *Glossopteris browniana*, but on one specimen (No. F 15/985/5) there is a plant of considerable interest.

The specimen shows a jointed stem with whorls of leaves at the nodes. There are two internodes and three nodes with their whorls of leaves preserved. The stem has a breadth of 2 mm. and the internodes are 1.7 and 2 cm. long. The whorls consist of from 18 to 20 leaves; those in a single whorl are unequal in length, the lateral ones in the specimen being the longest. The leaves unite to form a narrow basal collar; they are up to 3 mm. in breadth and 2 cm. in length and possess a prominent midrib. They are elongately lanceolate with a somewhat acute tip. Viewed under the microscope the midrib is seen to be striated longitudinally and some of the leaves show markings transverse to the midrib. These transverse markings appear to be of something more than a lithological character, but are not sufficiently definite to be regarded as venation.

The specimen agrees with those larger species of *Annularia* which are regarded as the foliage of Calamitean stems. It may tentatively be referred to *A. stellata* (Schloth.), and is somewhat like that figured by Seward.¹

In *Annularia* the leaves of a whorl are supposed to be in one plane; this character is difficult to determine in fossils, where the specimens are always on a flat surface. It is doubtful whether it is the case with the larger species which are the foliage of *Calamites*.

This specimen comes from strata belonging to the upper freshwater series (Newcastle Coal Measures) of the so-called Permo-Carboniferous System in New South Wales. As far as I have been able to ascertain no systematic collecting has been done in the district from which the specimen was obtained.

The only *Annularia* which has previously been recorded from the so-called Permo-Carboniferous rocks of Eastern Australia is *Annularia australis*² from the Greta Coal Measures of N.S.W.

Schmalhausen³ placed this species in his genus *Cyclopitys*, an equisetaceous-looking genus which he assigned to the conifers. Feistmantel,⁴ however, did

¹ Fossil Plants, vol. 1, p. 339, fig. 88.

² Feistmantel, Palæontographica, Suppl. Band. iii, 1878-9.

Tenison-Woods, Proc. Linn. Soc. N.S.W., viii (1883), p. 86.

Etheridge Jr., Proc. Linn. Soc. N.S.W., 2nd ser., v, pt. 1, p. 47, plates ii, iii.

³ Bull. Acad. Sc. St. Pétersbourg, 1883, tome xxviii, p. 426, 2 plates.

⁴ Mem. Geol. Surv. N.S.W., Pal. No. 3, 1890, p. 83.

Palæontologia Indica, Fossil Flora Gondwana Sm., vol. iv, pt. 2, p. 44.

not agree with Schmalhausen in this determination. Arber⁵ expresses doubt as to whether the specimens called *Annularia australis* may correctly be referred to the genus *Annularia*. They almost certainly do not belong to *Cyclopitys*. They are fragmentary and it seems probable that they may be fragments of *Phyllothecca*.

The present specimen then is the first one of *Annularia* from New South Wales. Arber⁶ has pointed out that the association of *Annularia* (a type of Calamitean foliage) with the *Glossopteris* flora indicates a mingling of northern and southern types of Permo-Carboniferous plants, and he says "the absence, so far, of any trace of a Calamitean stem in these rocks is somewhat remarkable if the species in question [*A. australis*] is really the foliage of a Calamite." It is quite possible that further collecting in this district may produce such stems.

The existence of the continent of Gondwanaland has lately been questioned by Matthew⁷ who, arguing strongly for the permanency of the ocean basins, believes that it is unnecessary to postulate such a continental land-mass to account for the peculiar distribution of the *Glossopteris* flora.

He argues that "the principal lines of migration in later geological epochs have been radial from Holarctic centres of dispersal." Should this prove to be the case as far back as Carboniferous, associations of the so-called northern and southern types of Permo-Carboniferous plants would be, perhaps, more easily explained than at present.

Annularia is abundant in the Upper Carboniferous and Permian rocks of the Northern Hemisphere. Several species of Calamitean stems are known from the Carboniferous rocks of New South Wales and Queensland.

Specimen: *Annularia stellata* (?)

Locality: Eight miles from Dunedoo, New South Wales.

Registered number: F 15/985/5.

⁵ *Glossopteris* Flora, British Museum Cat., 1905, p. 30.

⁶ Loc. cit.

⁷ Ann. New York Acad. Sc. xxiv (1915), p. 190.



ANNULARIA STELLATA (?).

Nat. size.

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VOL. V.

BRISBANE:
ISSUED JULY 10, 1916.

EDITED BY THE DIRECTOR,
R. HAMLYN-HARRIS, D.Sc., F.L.S., F.R.M.S., F.Z.S., &c.



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